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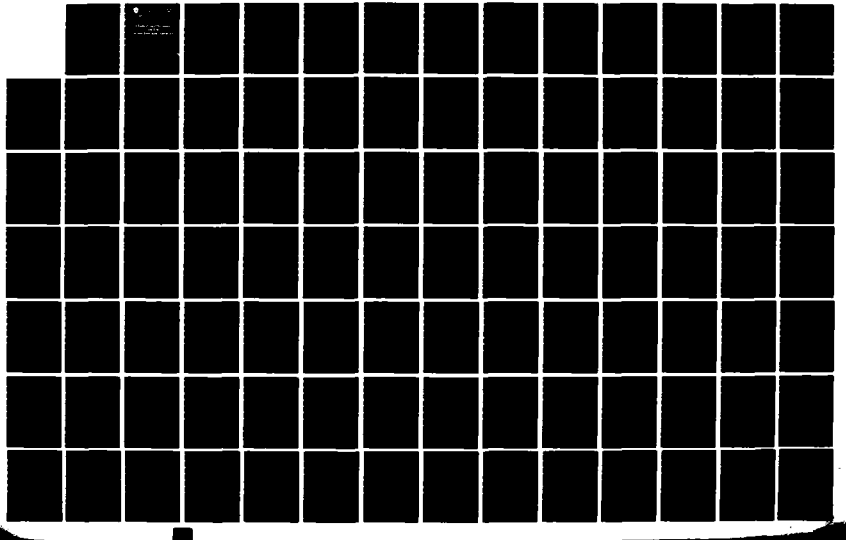

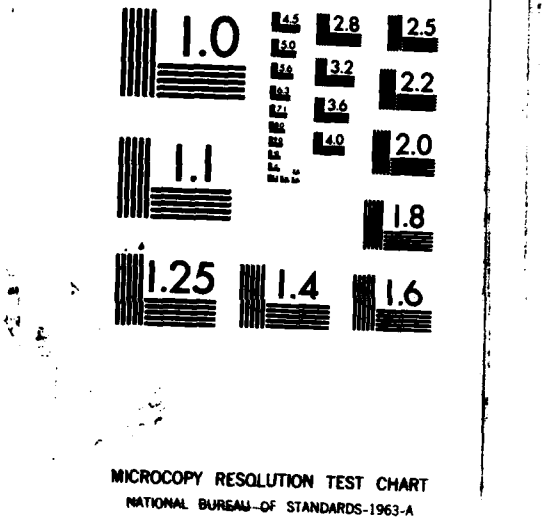

UNITED STATES ARMY RECRUITING COMMAND

Study Report 81-3 AD

A Study of the Effectiveness of the Army's National Advertising Expenditures

Volume III
Appendices

N W AYER INCORPORATED

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

ARMY ADVERTISING COST EFFECTIVENESS MODEL

The Army's advertising expenditures were shown to be cost effective in a contemporaneous modeling process. Advertising was related to ASVAB exams, and exams were then related to accessions.

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FOREWORD

The U.S. Army Recruiting Command (USAREC) has asked N W Ayer Incorporated to study the effectiveness of the Army's national recruitment advertising. N W Ayer's Marketing Services Department undertook this task in September, 1979, with guidance from USAREC's Program Analysis and Evaluation Division. In addition, their assistance in acquiring, providing, and checking data and data sources was essential.

Volume I is the Executive Summary and is intended for the general reader who wants an overview of the project's objectives, methods, and key findings. This summary highlights the marketing and financial aspects of the analysis.

Volume II is the Main Report and is intended for the reader who wants to fully understand the details of the project: its inception, methodology, data, results, validation, and economic implications.

Volume III is comprised of Appendices intended for the specialist who wants to thoroughly analyze the methods and data used in the analysis. A step by step description of how the model was built is documented in the Appendix entitled "Essential Elements of Analysis."

At our request our methodology and conclusions have been reviewed by Professor Martin K. Starr of the Graduate School of Business of Columbia University. He judged our statistical procedures sound and the conclusions acceptable on a statistical and analytic basis.

The findings in this report are not to be construed as an official Department of the Army position, unless so designated by other authorized documents.

VOLUME III
APPENDICES

ESSENTIAL ELEMENTS OF ANALYSIS APPENDIX

UNTRANSFORMED DATA SERIES APPENDICES

Data Appendix A. Performance Variables

Accessions by Date of Contract

A.1 High School Degree/Category I-IIIA
A.2 High School Degree/Category IIIB-IV
A.3 Non Degree/Category I-IIIA
A.4 Non-Degree/Category IIIB-IV

ASVAB Exams

A.5 Category I-IIIA
A.6 Category IIIB-IV

Data Appendix B. Media Variables

Advertising Spending

B.1 Television
B.2 Radio
B.3 Newspaper
B.4 Outdoor
B.5 Direct Mail
B.6 Local Advertising
B.7 Regular Magazines
B.8 Special Magazines

Media Deflators

B.9 Spot Television
B.10 Network Television
B.11 Spot Radio
B.12 Network Radio
B.13 Newspapers
B.14 Magazines
B.15 Outdoor

Data Appendix C. Policy Variables

C.1 Recruiter Accession Objectives
C.2 E1 Pay
C.3 Recruiter Numbers

Data Appendix D. Environmental Variables

D.1 Youth (16-19) Unemployment
D.2 Civilian Minimum Wage

ADJUSTED OR TRANSFORMED DATA SERIES APPPENDICES

Data Appendix E. Performance Variables

Accessions by Date of Contract (the December 1976 GI Bill determined spike removed from the data)

E.1 High School Degree/Category I-IIIA
E.2 High School Degree/Category IIIB-IV
E.3 Non Degree/Category I-IIIA

ASVAB Exams (the December 1976 gI bill Determined spike removed from the data)

E.4 Category I-IIIA
E.5 Cateogry IIIB-IV

Data Appendix F. Media Variables

Advertising spending (deflated to constant Dec. 1978 dollars, and adjusted to reflect net spending levels throughout)

F.1 Television
F.2 Radio
F.3 Newspaper
F.4 Outdoor
F.5 Direct Mail
F.6 Local Advertising
F.7 Regular Magazines
F.8 Special Magazines

Aggregated Advertising Spending (aggregation is over deflated net dollars)

F.9 Total Media at Current period
F.10 Total Media Sum of Periods T-4 through T-11
F.11 Television (lagged 1 period) + Local Advertising + Newspaper
F.12 Total Media - Sum of Current Period Through Period T-5

Data Appendix G. Policy Variables

G.1 Recruiter Accession Objectives - Twelve Month Centered Moving Average
G.2 Recruiter Accession Objectives - Ratio of Monthly Objectives to Moving Average
G.3 Relative Pay - the Ratio of E1 Pay to the Civilian Minimum Wage

ESSENTIAL ELEMENTS

OF ANALYSIS

Section A.1. HOW DOES THE RECRUITING PROCESS WORK?

It was necessary to begin the model-building procedure by developing an overview of the system under consideration (See figure A.1.1. for a schematic perspective of the system). The objective of developing this process perspective was not to incorporate into it every element of the recruiting system, but to outline those elements which are critical to developing a measurement of the influence of advertising spending levels. With this measurement based on a sound understanding of the process dynamics, the risk of confounding the impact of advertising spending with other system factor changes was considerably lessened.

This overview of the recruiting process specifies that the pool of eligible enlistment candidates receives a continual flow of information that impacts perceptions about the viability of enlistment in the Army. This input comes from both the Recruiting Command with information about Army pay, benefits and training opportunities; and from the general economic environment, with information about alternative employment, educational, and military service opportunities.

The quantity and quality of this information acts to impact both the level of awareness of opportunities offered by the Army and attitudes toward the Army, thus creating an atmosphere that affects responsiveness to contacts made by the recruiter force and inducing people to seek out recruiters on their own.

The ability of the recruiters as salesmen to present Army pay and benefits in a manner competitive with alternative service recruiting efforts results in the number of candidates who make a commitment to begin the enlistment process by going to an Armed Forces Enlistment Entry Station (AFEES) and taking mental and physical exams. Data on the number of candidates completing the examination process each month is available as a measure of performance of the recruiting system.

Once the examination process has been completed, the percentage of signed contracts is heavily dependent on the manpower requirements of the Army, as well as on the effectiveness of the career counseling staff in matching examinee abilities and interests with available MOS slots.

Finally, the time of accession for those who sign contracts is primarily determined by the flexibility of the DEP policy and by school-related seasonality.

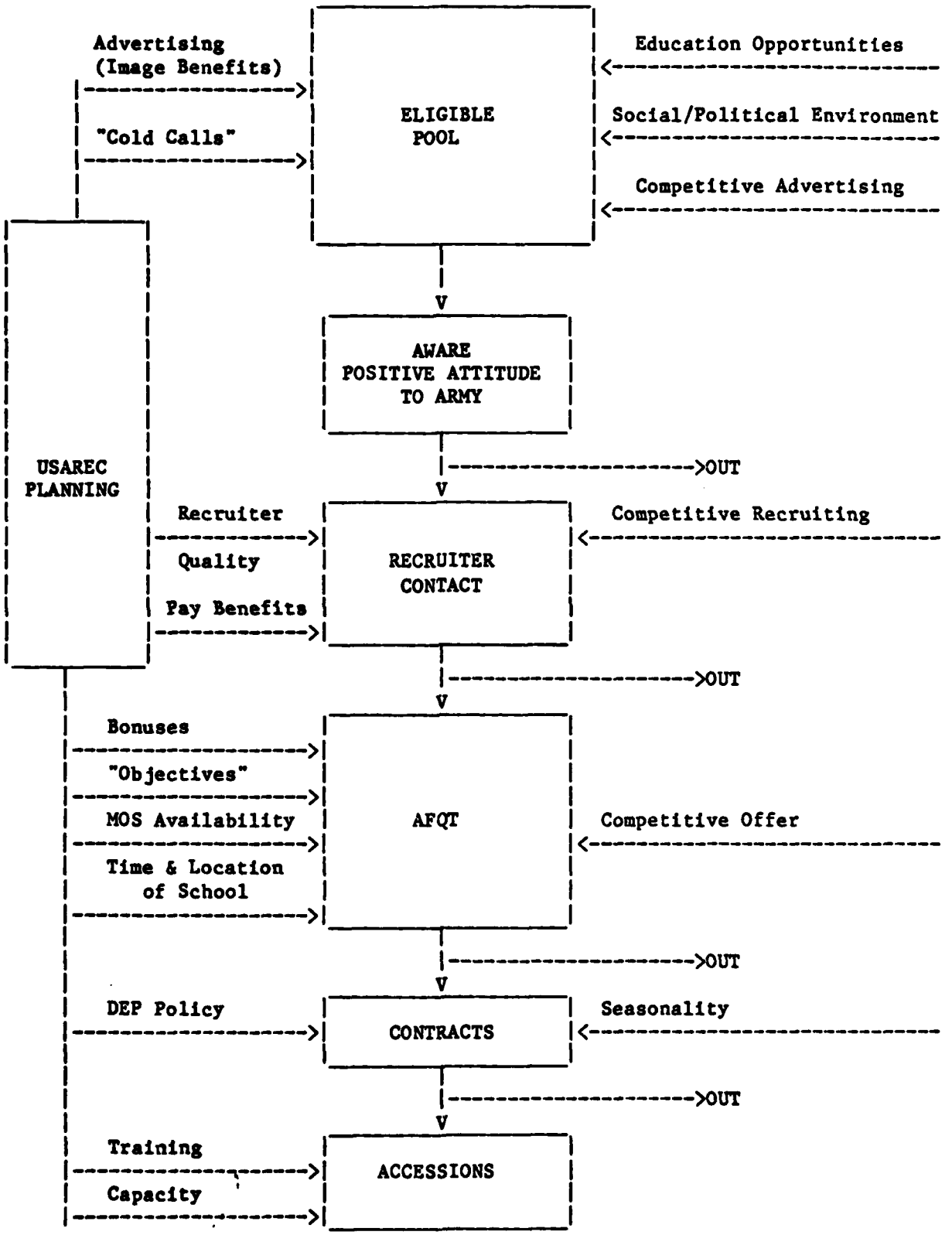

Figure A.1.1. Process Overview

Careful consideration of the process flow makes it clear that the system payoff, the number of accessions achieved each month, is considerably "downstream" from the impact of changes in the level of advertising spending, which is the critical variable under investigation.

Monthly data was not available that reflects changes in awareness levels and attitudes of the target market toward the Army, nor was monthly data available on the number of contacts made with the recruiting system.

However, the number of ASVAB exams completed each month was available, and represents the system performance measure furthest "upstream" in the process for which data was available.

In order to measure the response of the system at the point most sensitive to changes in the level of advertising, exam counts, as well as to track variations in the key payoff measure, accession levels, the process was viewed in two stages:

Stage 1: Relate Exam levels to changes in advertising, other policy variables, and critical non-controllable environmental influences.

Stage 2: Relate Accession levels to changes in Exam levels.

Figure A.1.2 simplifies the process perspective in terms of the two stages.

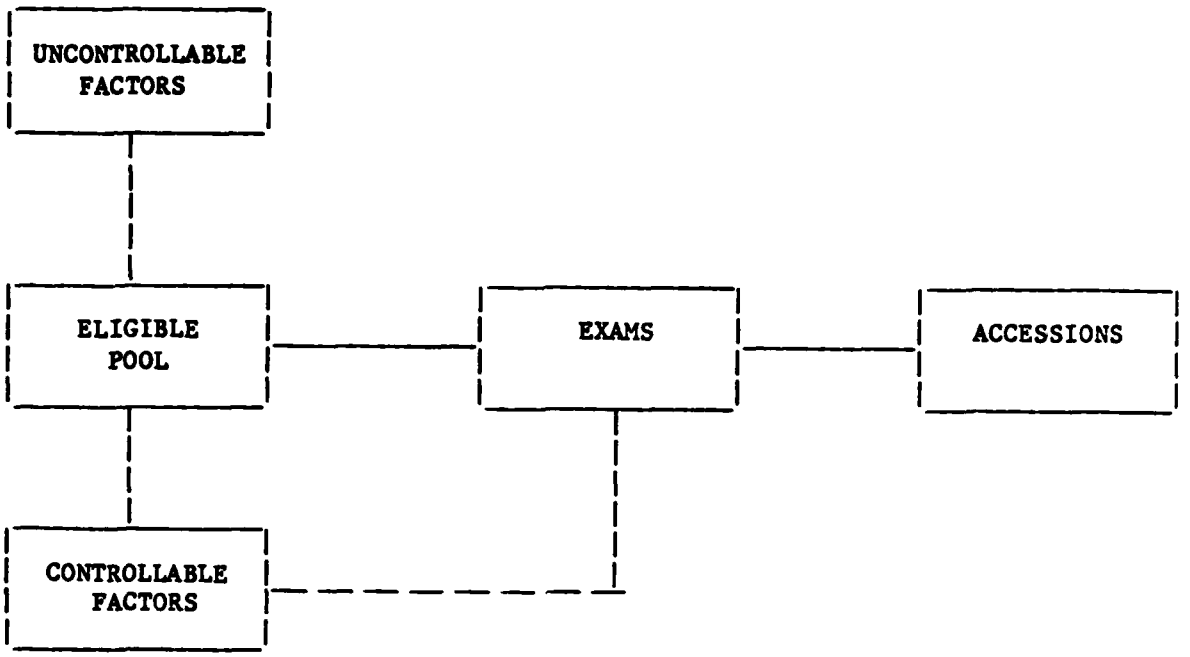

Figure A.1.2. Simplified Process Perspective

Section A.2. HOW IS THE MARKET SEGMENTED?

Army priorities for the quality of the recruit mix required investigating the differential impact of advertising on key market segments. Segmentation was based on high school degree status and mental category test scores:

- High School Degree - Category I-IIIA
- High School Degree - Category IIIB-IV
- Non-Degree - Category I-IIIA
- Non-Degree - Category IIIB-IV

The first segment deserves the highest priority; therefore, this group's differential response to advertising pressure, as compared with that of the other groups, was of particular interest in this analysis.

For the next two groups, some quality is lost with respect to test scores or degree status. The relative priority that these two groups receive would depend on whether the Army's current interest is in degree status or mental category.

The last group was considered to be more constrained by the demands of the Army than by the supply of candidates because accession variation reflects administrative pressures as much as response to marketing efforts; therefore, this group was not subjected to the same degree or detail of analysis.

The appropriate degree status could not be specified in the exam data, since the records reflect the status at the time of examination, not at the time of accession, and therefore underrepresent the number of graduates. With this restriction in mind, the exam data was partitioned by mental test scores into two groups, Category I-IIIA and Category IIIB-IV, and an exam model was built for each.

The two exam segments were used in the first stage of the two-stage process, and each of the three accession segments considered was then related to the appropriate exam group in the second stage.

Section A.3. WHAT KEY FACTORS ARE IN THE DATA BASE?

The data used in the analyses can be classified into four sets:

- Measures of Recruiting Performance
- Measures of Advertising Expenditure Activity
- USAREC Controllable Policy Variables
- Non-controllable Environmental Influences

Each of the variable groupings will be briefly discussed in this section. A more complete discussion of each variable, including a listing is included in the data appendix.

Measures of Recruiting Performances.

ASVAB 6-7 EXAMINATION COMPLETIONS:

This variable measures the number of exams completed each month in the AFEES stations.

ACCESSIONS BY CONTRACT DATE:

Accession records were reviewed and each accession was allocated to the month in which the enlistment contract was signed. This is effectively a contract series exclusive of those contracts that do not result in final accession. To our knowledge, this is the first time that recruiting performance has been measured using a criterion so far "upstream" in the process.

Measures of Advertising Expenditure Activity.

The advertising data used in the analysis reflects historical monthly expenditures, as reported in N W Ayer media archives, used to purchase advertising space targeted toward the non-prior service market segment.

Three key considerations in specifying the advertising variables are that

- individual media components were analyzed to account for differing responses;
- The reported dollar expenditures for each medium needed to be properly adjusted by the appropriate media deflator so that all expenditure levels throughout the analysis were reported in constant dollars (December 1978 = 1.00); and
- gross expenditures (including agency commissions) were adjusted to net expenditures (exclusive of agency commissions) where necessary.

Table A.3.1 lists the media components into which the total media expenditures are broken.

USAREC-Controllable Policy Variables.

RECRUITER ACCESSION OBJECTIVES:

This variable reflects monthly objectives for male non-prior service accessions as a measure of both long- and short-term "pressure" on the system.

E-1 PAY:

This variable was used in the analysis as a component in the relative pay ratio comparing the level of E-1 pay to the civilian minimum wage.

PRODUCTION RECRUITERS:

This variable represents the number of recruiters and commanders on station each month, and reflects variations in the size of the recruiter force.

Non-Controllable Environmental Influences.

YOUTH UNEMPLOYMENT:

This variable represents the monthly unemployment rate for 16 to 19 years olds.

CIVILIAN MINIMUM WAGE:

This variable represents the monthly minimum wage as legislated by Congress, and is the second component in the relative pay ratio.

NAVY ADVERTISING:

This variable represents the total monthly advertising media expenditures by the U.S. Navy, and is the only competitive advertising data whose accuracy was confirmed.

Table A.3.1. Media Components

(1) Television (space costs for network and spot television)

(2) Radio (space costs for network and spot radio)

(3) Newspaper

(4) Outdoor (space costs for outdoor billboards)

(5) Regular Magazines

(6) Special Magazines (primarily "Source Book" and "On Your Own")

(7) Local Advertising (primarily newspaper ads placed locally by the local recruiting commands)

(8) Direct Mail

Section A.4. WHAT FACTORS ARE NOT IN THE DATA BASE?

Ideally, the impact of variations in factors not included in the model specification will be small and independent of the factors included, so as not to cause a serious bias in the estimation of the model coefficients.

Table A.4.1 lists some of the factors that could impact the performance of the recruiting system but which were not easily quantifiable, and therefore were not included in the data base.

Table A.4.1. Factors Not in the Data Base

- MOS Availability
- Time & Location of MOS School
- Offers From Other Services
- Bonuses Offered
- Recruiter Quality
- Social & Political Events
- Creative Changes in Advertising

Section A.5. WHAT TIME FRAME DOES THE ANALYSIS COVER?

The time frame used to develop the analysis was determined by the availability of the examination and accession data. Exam models were built on 54 monthly observations covering the period April, 1976 to September, 1980. Accession models were built on 48 monthly observations covering the period April, 1976 to March, 1980.

Section A.6. WHY AND HOW WAS A TWO-STAGE PROCEDURE SELECTED?

The primary objective of the analysis was to measure the impact of changes in advertising spending levels on the recruiting system's performance.

As noted earlier, there is considerable administrative influence on the system between the time that changes in advertising spending impact prospects' interest level in the Army and the time that that impact on the interest level is reflected in the accession levels.

In order to maximize our ability to read the effects of advertising, we chose to describe the system by the two-stage process that was noted in the overview section. The two-stage nature of the process, as well as the need for evaluating accessions on a market segment basis, required the following model-building procedure:

(1) A model was built for each of the two exam segments, each relating the number of ASVAB exams completed each month to controllable and uncontrollable factors.

(2) A second model was developed for each of three accession segments, each using the number of completed exams as input, and relating the number of accessions (by contract date) to the number of completed exams as well as to other key policy variables.

Section A.7. WHAT WAS THE EXAM MODEL-BUILDING STRATEGY?

The first step in the two-stage process was to build an exam model relating advertising changes to variations in exam levels for each of the two exam groups: mental categories I-IIIA and IIIB-IV. The strategy used to develop the exam models can be outlined in seven basic steps:

1. Determination of those factors whose variation should affect the level of exams.

2. Examination, using the Box Jenkins "pre whitened" cross-correlations technique[1], of the dynamic pattern between exams and each of the non-advertising variables to determine whether the variable under consideration has a significant immediate or delayed effect. Advertising variables were not considered at this time, in order to reduce the variability in exams before trying to measure the effects of the individual advertising media.

3. Assumption that each non-advertising variable would have an immediate effect. In some cases, the variable was dropped from further consideration after analyzing the cross-correlations. In other cases, a delayed effect was added to the current-effect hypothesis.

4. Use of multiple regression to verify that each factor had significant marginal effect on exam variation. A multivariate model was developed to best explain the portion of exam variation determined by the covariate factors. This model is referred to as the "pre-advertising model."

5. Development of a time series of residuals from the pre-advertising model to represent that part of the exam variation that is determined by advertising and unidentifiable factors that affect recruiting.

6. Use of the Box Jenkins technqiue to identify the dynamic pattern between changes in advertising spending levels by individual media and variation in the residual series.

7. Estimation of the parameters of a model including both non-advertising and advertising variables.

The specifics of implementing the strategy for building the Category I-IIIA model is discussed in Section A.8, and for building the Category IIIB-IV model in Section A.9. This detail includes discussion of data pattern analysis, seasonality, special data adjustments, comments on the cross-correlations, and results of multiple regression runs.

---

[1] The analysis of cross correlations is described in detail by George E.P. Box and Gwilym M. Jenkins in Time Series Analysis, published by Holden Day (San Francisco, 1976).

Section A.8. WHAT WERE THE KEY FINDINGS OF EXAMINING THE CATEGORY I-IIIA EXAMS?

This discussion starts with the inspection of data patterns, continues with the testing of model specification structures, and concludes with the description of a final model. In the process, all key findings are supported with detailed analyses.

Section A.8.1 What Seasonality Was Found For Category I-IIIA Exams?

Regular seasonal variation in the exam data reflects both seasonality in the environmental factors affecting the availability of candidates for enlistment and seasonal patterns in the manpower processing patterns of the Army.

In order to identify these seasonal patterns a standard technique was used: the ratio of each month's exam level to a twelve-month moving average was computed (Table A.8.1.1).

As seen in the Table, January was consistently higher while both the April-May and September-October periods were consistently lower than average. We therefore hypothesized that the use of dummy variable indicators - one for January, another for April and May, and a third for September and October - would be appropriate.

With the seasonal pattern thus identified, we looked at the data for other systematic patterns, and identified a GI Bill effect which is discussed in the next section.

Table A.8.1.1. Ratio of CAT I-IIIA Exams to a Twelve-Month Moving Average For Every Month of Data

	1976	1977	1978	1979	1980
JAN		1.04	1.14	1.25	1.24
FEB		1.04	1.08	1.05	1.22
MAR		1.10	1.11	1.09	1.01
APR		.91	.85	.90	
MAY		.81	.73	.89	
JUN		1.01	1.03	.93	
JUL		.94	.93	1.09	
AUG		1.01	1.08	1.04	
SEP		.85	.90	.79	
OCT	.90	.90	.91	.85	
NOV	1.20	1.12	1.02	.91	
DEC	1.11	1.06	.95	.81	

Section A.8.2 Why And How Was Exam Data Adjusted To Remove Effect Of GI Bill Termination?

A plot of the monthly Exam series clearly shows a drop beginning in January 1977 (See figure A.8.2.1). This change in the process level coincides with the termination of the GI Bill of Rights as of the end of 1976, as well as with an overall lowering of resources applied to the recruiting process.

In addition to the drop in the level, the number of exams processed in December 1976 was extraordinarily high. It was reasonable to assume that this represented a last minute system "loading" to take advantage of the GI Bill; therefore, this period was treated as an "outlier," and the number was replaced by the pre-1977 process mean. The reduction in the exam rate was captured and modeled with a 1-0 dummy variable, which signalled when the GI Bill was in effect. We felt it necessary to take the effect of this process change out of the data in order to effectively evaluate the correlational pattern of exams with the other variables. The data was adjusted by subtracting from the exam series the mean computed for the data prior to January 1977 and the mean computed after January 1977.

The resulting residual series was used as the performance measure in investigating the relationship of recruiting with the other factors. This series is seen in Figure A.8.2.2, and is called REXA.

With the regular patterns in the data identified in terms of seasonality and GI Bill Termination, we could go on to an examination of the impact of the non-advertising variables.

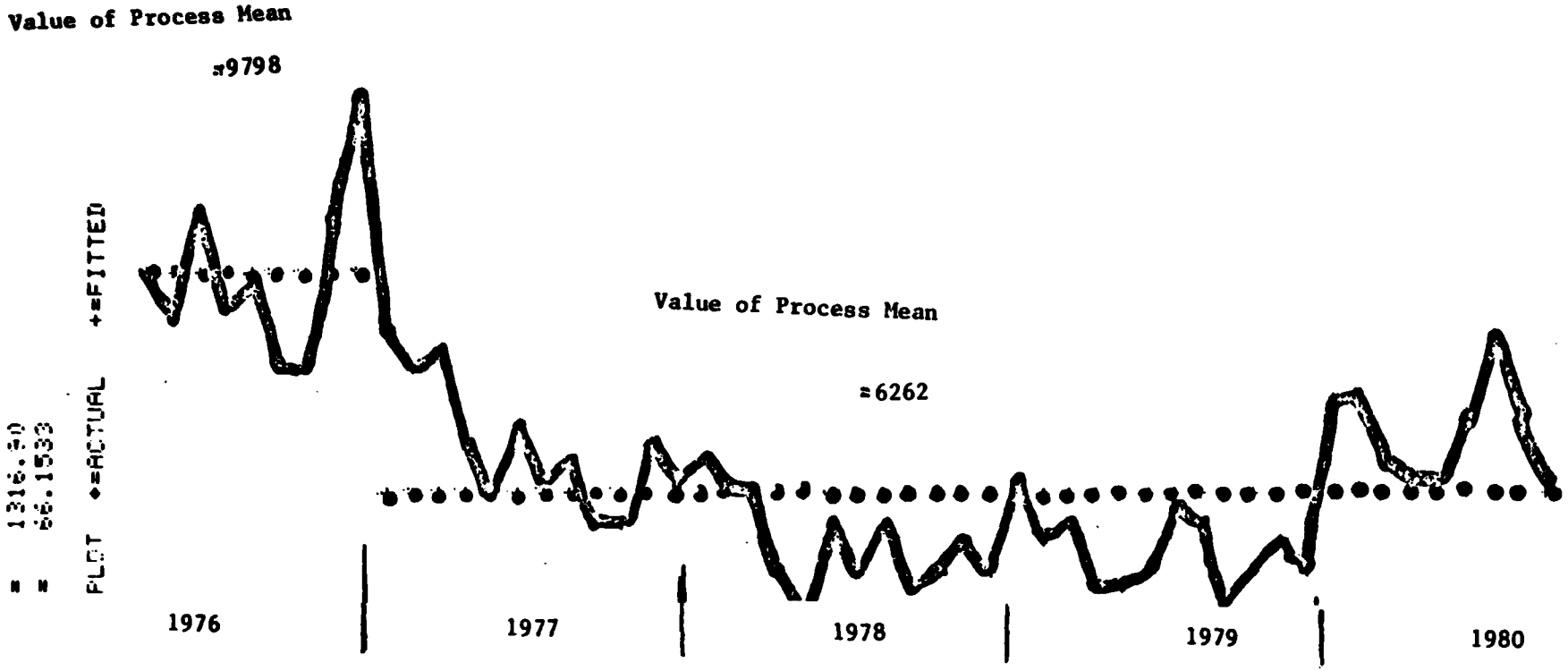

Figure A.8.2.1. Effect of GI Bill on Category I-III Exams

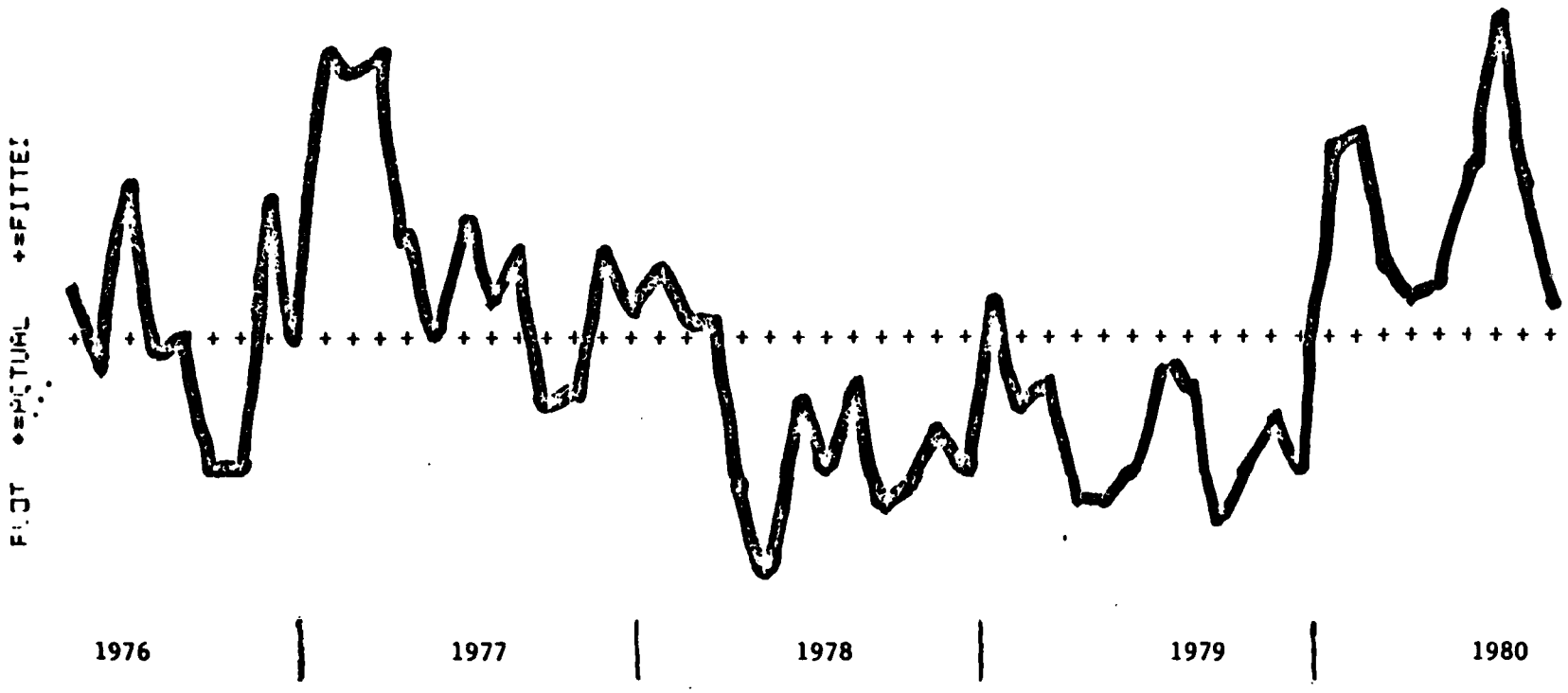

Figure A.8.2.2. Category I-IIIA Exam Residuals (GI Bill termination effect out)

Section A.8.3. How Do The Key Variables Other Than Advertising Impact Exam Variation?

The basic relationship between exam variation and each of the non-advertising factors expected to be key determinants of the process was examined using cross-correlation analysis.

We used the Box Jenkins method of "pre-whitening" the data to remove systematic variations before computing the cross correlations.

Evaluation of the Cross-Correlations

The analysis of the pattern in the cross-correlations was designed to provide insight into the delay structure between changes in the key factors and exam variation (adjusted for GI Bill termination). The "pre-whitened" cross-correlations between the adjusted exam series (called REXA) and each of the factors under consideration were computed for the current period and for lags of up to one year.

The following guidelines were applied in using the patterns seen in the cross-correlations to determine the structure of the variables to be included in the model:

- Current effects were always assumed to be appropriate and would be tested in the regression model even if they did not show up in the cross-correlations.
- Effects at those lags where the cross-correlations had signs that are opposite to the way the process would reasonably be expected to operate were not considered.
- Effects at lags where significant cross-correlations appeared to be the result of systematic variation due to a factor other than the variable under investigation, such as joint seasonality, were not considered.

The patterns and key observations for each of the variables is discussed in turn. The actual cross-correlations that were evaluated follow the discussion in tables A.8.3.1 through A.8.3.5, and the graphs of the impulse response weights are included in the tables. These weights are a simple transformation of the cross-correlations, and outline the distributed impact, at each lag, caused by a "spike" in the value of the variable being examined.

YOUTH UNEMPLOYMENT:

There was a significant cross-correlation at the one month lag. This suggests that increased unemployment has some effect on enlistment (See Figure A.8.3.1). An average of the current and previous period unemployment rate was hypothesized to capture the effect.

RECRUITING OBJECTIVES:

The cross-correlations between the residual exam series and recruiting objectives show a positive effect for the current period and for all lags, with particularly strong effects at lags 2, 7, and 10 (See Figure A.8.3.2).

There is a strong delay structure built into the relation between these two series since the objectives are for accessions, which lag behind the exam completion rate due to the Delayed Entry Program. In addition, both series have seasonal fluctuations, and the differences in seasonal peaks induce an apparent lag structure. Therefore, a delay structure was not deemed appropriate and only the current effects were used.

RELATIVE PAY (E1 Pay/minimum wage):

The cross-correlation between the adjusted exam series and the relative pay ratio showed positive responses for the current period and for lags of 3 and 8 periods (See Figure A.8.3.3).

Again, there is seasonality in the two series. E1 pay is raised every October at the beginning of the fiscal year, and the minimum wage rate is increased three months later in January. This would seem to account for the apparent delay structure, so only the current effect was considered. Although the current effect is not larger than two standard deviations, it was hypothesized given the strong theoretical connection between the demand for a job and the pay for the job.

PRODUCTION RECRUITERS:

The cross-correlations between the number of production recruiters and the adjusted exam series show positive response for the current period and for the first three lags (See Figure A.8.3.4).

Although none of the correlations were larger than two standard deviations, an immediate effect was hypothesized, since discussions with recruiters indicate that recruiters try to schedule the prospect to take the exam within days of first contact.

NAVY ADVERTISING:

The cross correlations between monthly Navy advertising expenditures and the adjusted exam series were negative at all lags, but none were as large as one standard deviation (See Figure A.8.3.5).

This suggests directional but rather weak evidence that increases in Navy advertising expenditure levels result in a depressing effect on the number of people who are stimulated to pursue Army enlistment by taking the ASVAB exams. Since the evidence was weak, and also since the Navy advertising expenditure data was only available through 1978, this variable was dropped from further consideration.

CROSS CORRELATIONS

SERIES 1 - PREWHITENED UNEM
SERIES 2 - PREWHITENED REXA

MEAN OF SERIES 1 = -.23981E-01
ST. DEV. OF SERIES 1 = .11129E+01
MEAN OF SERIES 2 = .18065E-01
ST. DEV. OF SERIES 2 = .70395E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.108	0	-.108
1	.334	1	.064
2	.036	2	-.142
3	-.007	3	.069
4	-.023	4	.441
5	.161	5	-.013
6	.137	6	-.003
7	-.131	7	.099
8	-.059	8	-.141
9	-.080	9	-.129
10	.046	10	.052
11	-.189	11	-.143
12	.107	12	.168

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-.264 0. .264
		.+++++++++.+++++++++.+++++++++.+++++++++.
-.068	0	XXXXXX
.211	1	XXXXXXXXXXXXXXXXXX
.023	2	XXX
-.004	3	X
-.014	4	XX
.102	5	XXXXXXXXX
.087	6	XXXXXXXX
-.083	7	XXXXXXX
-.037	8	XXXX
-.050	9	XXXXX
.029	10	XXX
-.120	11	XXXXXXXXXX
.067	12	XXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 1

Figure A.8.3.1. Cross-Correlations
CAT I-III Exams (Adjusted) vs. Youth Umemployment

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CROSS CORRELATIONS

 SERIES 1 - PREWHITENED RECO
 SERIES 2 - PREWHITENED REXA


 MEAN OF SERIES 1      =  -.12565E+00
 ST. DEV. OF SERIES 1  =   .18748E+01
 MEAN OF SERIES 2      =  -.90674E-02
 ST. DEV. OF SERIES 2  =   .81278E+00
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.326	0	.326
1	.231	1	-.073
2	-.004	2	.091
3	.286	3	.016
4	.163	4	-.086
5	.185	5	-.152
6	.132	6	-.064
7	.352	7	-.194
8	.217	8	-.102
9	.220	9	-.041
10	.341	10	-.073
11	.229	11	-.051
12	.229	12	-.177

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

    VALUES        -.191                0.                  .191
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     .141     0                        XXXXXXXXXXXXXXXX
     .100     1                        XXXXXXXXXX
    -.002     2                        X
     .124     3                        XXXXXXXXXXXX
     .071     4                        XXXXXXX
     .080     5                        XXXXXXXX
     .057     6                        XXXXXX
     .153     7                        XXXXXXXXXXXXXXX
     .094     8                        XXXXXXXXX
     .095     9                        XXXXXXXXX
     .148    10                        XXXXXXXXXXXXXX
     .099    11                        XXXXXXXXX
     .099    12                        XXXXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   1 , S =   0 AND DELAY =   0
```

Figure A.8.3.2. Cross-Correlations
CAT I-III Exams (Adjusted) vs. Recruiter Objectives

CROSS CORRELATIONS

SERIES 1 - PREWHITENED PE1
SERIES 2 - PREWHITENED PEXA

MEAN OF SERIES 1 = -.37562E-02
ST. DEV. OF SERIES 1 = .17855E-01
MEAN OF SERIES 2 = -.89751E-02
ST. DEV. OF SERIES 2 = .68145E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.180	0	.180
1	.078	1	-.076
2	.053	2	.040
3	.193	3	.043
4	.020	4	.158
5	-.260	5	-.065
6	-.046	6	-.081
7	-.085	7	-.025
8	.139	8	.031
9	.060	9	.066
10	-.050	10	.004
11	-.061	11	.022
12	-.295	12	-.013

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-14.082 0. 14.082
		.+++++++++.+++++++++.+++++++++.+++++++++.
6.859	0	XXXXXXXXXXX
2.992	1	XXXXX
2.032	2	XXXX
7.371	3	XXXXXXXXXXX
.748	4	XX
-9.936	5	XXXXXXXXXXXXXXX
-1.768	6	XXXX
-3.250	7	XXXXXX
5.317	8	XXXXXXXXX
2.281	9	XXXX
-1.907	10	XXXX
-2.318	11	XXXX
-11.265	12	XXXXXXXXXXXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.8.3.3. Cross-Correlations
CAT I-IIIA Exams (Adjusted) vs. Relative Pay

CROSS CORRELATIONS

SERIES 1 - PREWHITENED ARCR
SERIES 2 - PREWHITENED REXA

MEAN OF SERIES 1 = .12791E-01
ST. DEV. OF SERIES 1 = .82230E-01
MEAN OF SERIES 2 = -.79392E-02
ST. DEV. OF SERIES 2 = .10655E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.124	0	.124
1	.182	1	-.087
2	.124	2	.099
3	.065	3	.056
4	-.236	4	.002
5	-.082	5	.143
6	-.032	6	.113
7	.117	7	-.013
8	.059	8	-.095
9	.025	9	.037
10	-.035	10	.023
11	-.040	11	-.056
12	.081	12	-.033

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-3.818 0. 3.818
		.+++++++++.+++++++++.+++++++++.+++++++++.
1.612	0	XXXXXXXXX
2.358	1	XXXXXXXXXXXX
1.604	2	XXXXXXXXX
.841	3	XXXXX
-3.055	4	XXXXXXXXXXXXXXXXX
-1.059	5	XXXXXXX
-.415	6	XXX
1.520	7	XXXXXXXXX
.759	8	XXXXX
.329	9	XXX
-.451	10	XXX
-.518	11	XXXX
1.046	12	XXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.8.3.4. Cross-Correlations
CAT I-IIIA Exams (Adjusted) Vs. Recruiters

CROSS CORRELATIONS

SERIES 1 - PREWHITENED TND
SERIES 2 - PREWHITENED PENN

MEAN OF SERIES 1 = -.999993E-02
ST. DEV. OF SERIES 1 = .301403E+00
MEAN OF SERIES 2 = .385392E-01
ST. DEV. OF SERIES 2 = .108762E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.020	0	-.020
1	-.072	1	-.073
2	-.117	2	.325
3	-.109	3	.311
4	-.078	4	.078
5	-.065	5	-.070
6	-.147	6	-.106

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .193

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-.665	0.	.665
		.+++++++++.+++++++++.+++++++++.+++++++++.		
-.073	0	XXX		
-.259	1	XXXXXXXXX		
-.421	2	XXXXXXXXXXXXXXX		
-.393	3	XXXXXXXXXXXXXX		
-.280	4	XXXXXXXXX		
-.236	5	XXXXXXX		
-.532	6	XXXXXXXXXXXXXXXXXXX		

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.8.3.5. Cross-Correlations
CAT I-IIIA Exams (Adjusted) Vs. Navy Advertising

Section A.8.4. What Is The Pre-Advertising Model?

The patterns identified in the cross-correlation analysis were used to determine which of the variables under consideration should be included as key co-variates to advertising in the final model specifications.

With the key variables and the delay structure impacting exam variation identified, we developed a model specification called the Pre-Advertising model.

This model structures the relationship between exam variation and the key factors, with the exception of advertising. The parameters can be estimated using multiple regression.

With the pre-exam model identified, we can estimate the variation in exams for each month determined by the levels of the non-advertising variables. Subtracting these estimated values from the actual exam data leaves a time series whose variation should be determined by advertising variation and the net impact of all unidentified factors. Ideally, the impact of the unidentified variables will be small and this residual series can be used to effectively examine the impact of varying advertising spending levels.

The preceding correlation analyses suggest that the following factors should be included in the pre-advertising model:

- GI Bill termination (December 1976) - 1-0 dummy variable
- Youth Unemployment - average of current and one period lag
- Recruiting objectives - current period effect
- Relative pay - current period effect
- Production recruiters - current period effect
- Seasonality - 1-0 dummy variables
  - January - positive increment
  - April, May - negative increment
  - September, October - negative increment
- Auto-Regressive structure

Using multiple regression in order to jointly estimate the coefficients of the factors, we identified a model specification with computed "t" statistics greater than 2.0 for all variables with the exception of the April-May seasonal specification. This seasonal effect was apparently confounded with other factors and reflected redundant information; therefore, it was dropped from the specification list. The coefficients were estimated again under the reduced specification.

All of the estimated coefficients had computed "t" statistics greater than 2.0, and the resulting linear model was considered the appropriate pre-advertising model. The computed Durbin Watson statistic of 1.9 suggests no indication of a problem with auto-correlation in the residuals; therefore, an auto-regressive structure was not used.

The model is presented in Figure A.8.4.1.

This model specification explains the monthly variations in exams very well. The high percentage of explained variance (92%) and the lack of auto-correlation are evidence that the variables identified are key to describing the process.

The residuals of this model are seen in Figure A.8.4.2. These residuals are called RESX. They represent a measure of exam-taking actively adjusted for the key non-advertising factors. As such, the residuals serve as the criteria of recruiting success in the next section. These residuals account for a small proportion of exam-taking since the pre-advertising model explains 92% of the variation in exams. In fact, the residuals may be too small to completely reflect the variation in advertising. This is possible since some advertising effects may have been captured in the pre-advertising model by non-advertising variables, which would occur if there were a correlation between advertising and the non-advertising variables.

VARIABLE	COEFFICIENT	"t"
Constant	-16,860	-6.6
GI Bill Dummy	2,702	8.8
Unemployment (0-1)	402	8.1
Recruiter Objectives	.070	3.5
Relative Pay	7,535	4.3
Recruiters	1.79	4.8
January	1,233	4.0
September-October	-732	-3.2
Durbin Watson	1.9	
Multiple R Squared	.92	

Figure A.8.4.1. The Pre-Advertising Model for I-IIIA Exams

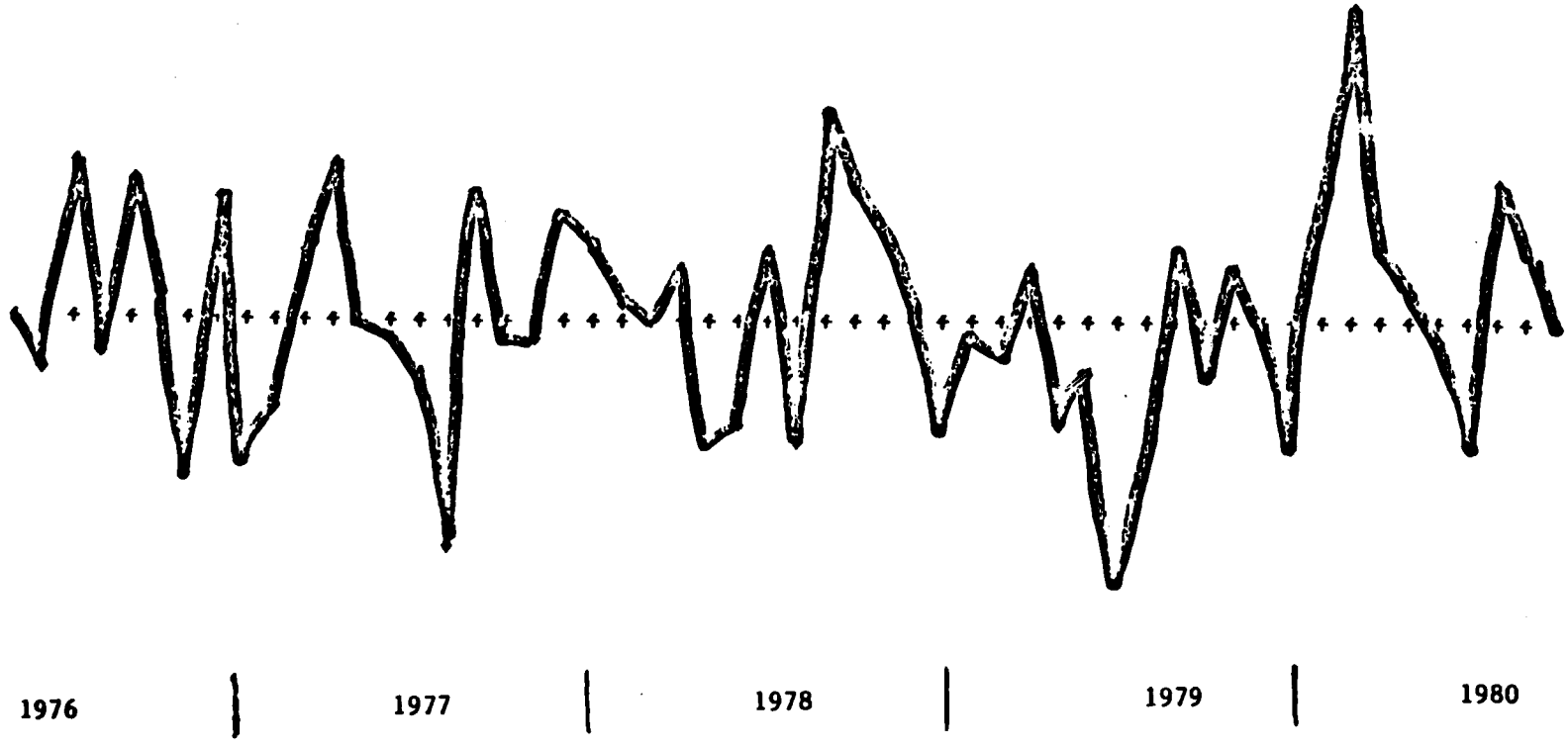

Figure A.8.4.2. Category I-IIIA Exam Residuals
(From Pre-Advertising Model)

Section A.8.5. What Effects Were Hypothesized For Each Of The Media?

Once the effects of the non-advertising variables were removed from exam variation, we addressed the analysis of advertising. Cross-correlations were used to identify the immediate and delayed effects of the advertising media. As in the analysis of the non-advertising variables, cross-correlations were computed between the residual series and each of the individual media variables for the current period, as well as for lags up to 12 periods (See Figure A.8.5.1).

The results of the individual cross-correlations (seen in Figures A.8.5.2 through A.8.5.9) are not clear cut. It would appear from the patterns that came out of the cross-correlation analysis that we attempted to achieve too high a level of resolution to identify specific response patterns for each medium.

The cross-correlation analysis provides an indication of the length of the response delays.

Figure A.8.5.1 provides a summary of the delay structures by indicating for each media component the lags at which the largest cross-correlations occurred. Two key characteristics emerge:

- All of the media, with the exception of television, show delays in the response at medium to long lags (4 to 12 months)
- Three media - TV, newspapers, and local advertising - show immediate (current period) or nearly immediate (1 period lag) response patterns.

The results of these analyses suggested that we concentrate on media aggregates, rather than trying to model the effects of individual media. We therefore examined cross-correlation for a total aggregate (see figure A.8.5.9).

The results of this total media aggregation are clearer. In this cross-correlation we see some evidence of an immediate effect up to one month after exposure, and evidence of a delayed effect of between 3 and 11 months.

In neither case do the cross-correlations for the aggregate media exceed two standard deviations. This is due to the intercorrelation among the independent variables (see Figure A.8.5.8). Aggregate advertising has a correlation of .17 with the GI Bill indicator and unemployment, a correlation of .13 with the January indicator, and a correlation of .43 with the September-October indicator. These correlations are nearly as great or greater than the correlation between advertising XMED and exams or exam residuals.

LAG	0	1	2	3	4	5	6	7	8	9	10	11	12
MEDIUM													
NEWSPAPERS	X									X			
RADIO					X						X		
OUTDOOR				X			X						X
REGULAR MAGAZINES				X	X								
SPECIAL MAGAZINES							X		X				X
DIRECT MAIL					X							X	
LOCAL	X				X					X			
TELEVISION		X											

Figure A.8.5.1. Category I-IIIA Exams Pre-Advertising Residuals
(Advertising Impacts are Strong at Indicated Lags)

ADVERTISING PRESSURE VARIABLES:

The pattern observed in the cross-correlations across the individiual and aggregate media can be summarized as follows:

- Some mid- and long-term delayed responses for all of the media (with the exception of TV).
- Some immediate (current period or one period delay) responses for three of the media (TV, newspapers, and local advertising).

These patterns suggested the following specification of advertising as two aggregate "pressure" variables:

(1) Total Media Aggregate with long-term delay: a moving sum of all media lagged four to eleven periods. The advertising pressure affecting current period exam levels is the result of the spending inventory built up from 11 months ago through four months ago

(2) Immediate Response: the sum of current period spending for newspapers and local advertising plus the most previous period spending for television.

The total media aggregate identified with the long-term delay structure can be viewed from two perspectives:

- The level of exam activity in any given month is directly related to the level of advertising inventory reflecting total advertising spending for an eight month period going back 11 months through four months ago.
- If there is an increase in advertising pressure in a specific month, the resulting impact on processed exams will not be seen for four months, and then the increased activity will continue at the same level for another nine months.

Both perspectives are an accurate interpretation of the distributed lag structure, but the first way of viewing the system requires less concern with the pattern of the lag weights, and easily accommodates the equal weight specification.

The two advertising variables, one capturing the immediate response of exam levels to changes in advertising spending, and one capturing the delayed can now be combined with the non-advertising variable to specify a complete model. This model will be discussed in the next section.

CROSS CORRELATIONS

SERIES 1 - PREWHITENED DN2
SERIES 2 - PREWHITENED RESX

MEAN OF SERIES 1 = -.22029E-01
ST. DEV. OF SERIES 1 = .20266E+00
MEAN OF SERIES 2 = -.52319E-03
ST. DEV. OF SERIES 2 = .51517E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.156	0	.156
1	-.134	1	-.222
2	-.147	2	.111
3	.142	3	.059
4	-.012	4	-.063
5	-.017	5	.147
6	-.173	6	-.096
7	.057	7	.111
8	-.144	8	.063
9	.240	9	.103
10	.101	10	-.111
11	-.095	11	-.093
12	.201	12	-.010

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-.763 0. .763
		.+++++++++.+++++++++.+++++++++.+++++++++.
.397	0	XXXXXXXXXX
-.339	1	XXXXXXXXX
-.374	2	XXXXXXXXXX
.361	3	XXXXXXXXX
-.032	4	XX
-.044	5	XX
-.441	6	XXXXXXXXXXXX
.146	7	XXXX
-.366	8	XXXXXXXXXX
.611	9	XXXXXXXXXXXXXXXX
.256	10	XXXXXXX
-.241	11	XXXXXX
.511	12	XXXXXXXXXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.8.5.2. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Newspaper Advertising

CROSS CORRELATIONS

SERIES 1 - PREWHITENED DP2
SERIES 2 - PREWHITENED PEIX

MEAN OF SERIES 1 = .19607E+02
ST. DEV. OF SERIES 1 = .14357E+03
MEAN OF SERIES 2 = -.67557E-04
ST. DEV. OF SERIES 2 = .62733E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.088	0	-.088
1	.007	1	.106
2	-.018	2	.087
3	-.010	3	-.213
4	.090	4	.067
5	.018	5	-.069
6	-.092	6	-.005
7	-.075	7	.209
8	.043	8	-.014
9	-.021	9	-.097
10	.147	10	.126
11	.053	11	-.040
12	-.083	12	-.083

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
   VALUES        -.001              0.                  .001
                  .+++++++++.+++++++++.+++++++++.+++++++++.
    -.000    0             XXXXXXXXXXX
     .000    1                      XX
    -.000    2                    XXX
    -.000    3                     XX
     .000    4                       XXXXXXXXXXX
     .000    5                      XXX
    -.000    6             XXXXXXXXXXX
    -.000    7               XXXXXXXXX
     .000    8                      XXXXXX
    -.000    9                    XXX
     .001   10                       XXXXXXXXXXXXXXXXXX
     .000   11                       XXXXXXX
    -.000   12                XXXXXXXXXX
```

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

**Figure A.8.5.3. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Radio Advertising**

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DO2
 SERIES 2 - PREWHITENED RESX


 MEAN OF SERIES 1      =  -.30537E-01
 ST. DEV. OF SERIES 1 =    .12957E+00
 MEAN OF SERIES 2      =  -.24199E-02
 ST. DEV. OF SERIES 2 =    .53568E+00
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.061	0	.061
1	-.289	1	.088
2	-.039	2	.006
3	.166	3	-.014
4	-.148	4	.007
5	-.001	5	-.005
6	.148	6	-.018
7	.043	7	-.004
8	-.063	8	.020
9	.097	9	-.024
10	-.010	10	.011
11	-.243	11	.043
12	.150	12	-.003

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
    VALUES       -1.495                0.                    1.495
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     .252    0                         XXXX
   -1.196    1       XXXXXXXXXXXXXXXXX
    -.159    2                      XXX
     .686    3                         XXXXXXXXXX
    -.613    4                XXXXXXXXX
    -.004    5                         X
     .613    6                         XXXXXXXXX
     .180    7                         XXX
    -.262    8                    XXXXX
     .400    9                         XXXXXX
    -.039   10                       XX
   -1.004   11           XXXXXXXXXXXXXX
     .620   12                         XXXXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   0 , S =   0 AND DELAY =   0
```

Figure A.8.5.4. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Outdoor Advertising

```
CROSS CORRELATION:

 SERIES 1 - PREWHITENED DPG2
 SERIES 2 - PREWHITENED PECK


 MEAN OF SERIES 1      =  -.60136E-01
 ST. DEV. OF SERIES 1 =    .16578E+00
 MEAN OF SERIES 2      =   .53090E-02
 ST. DEV. OF SERIES 2 =    .49841E+00
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.009	0	.009
1	.030	1	-.122
2	-.119	2	-.097
3	.283	3	-.153
4	.142	4	-.374
5	.099	5	-.271
6	.010	6	.023
7	-.034	7	-.002
8	.108	8	.092
9	.099	9	.157
10	-.030	10	-.041
11	-.140	11	-.047
12	-.040	12	.035

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

    VALUES      -1.062                0.                1.062
                  .+++++++++.+++++++++.+++++++++.+++++++++.
      .028    0                       XX
      .089    1                       XXX
     -.358    2                 XXXXXXXX
      .850    3                       XXXXXXXXXXXXXXXXX
      .426    4                       XXXXXXXXX
      .298    5                       XXXXXXX
      .089    6                       XX
     -.103    7                     XXX
      .325    8                       XXXXXXX
      .298    9                       XXXXXXX
     -.090   10                     XXX
     -.421   11                 XXXXXXXXX
     -.122   12                     XXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   0 , S =   0 AND DELAY =   0
```

Figure A.8.5.5. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Reg. Magazine Advertising

CROSS CORRELATIONS

SERIES 1 - PREWHITENED DSP2
SERIES 2 - PREWHITENED RESX

MEAN OF SERIES 1 = -.30371E-01
ST. DEV. OF SERIES 1 = .42372E+00
MEAN OF SERIES 2 = .88334E-02
ST. DEV. OF SERIES 2 = .50217E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.094	0	.094
1	-.047	1	-.114
2	.099	2	-.082
3	-.056	3	-.096
4	-.124	4	-.145
5	.111	5	.067
6	.255	6	-.013
7	.049	7	.090
8	.278	8	-.077
9	-.036	9	-.092
10	.037	10	-.008
11	.238	11	.179
12	.056	12	.041

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
  VALUES        -.412                0.                .412
                 .+++++++++.+++++++++.+++++++++.+++++++++.
   .112    0                        XXXXXX
  -.055    1                      XXXX
   .118    2                        XXXXXXX
  -.066    3                      XXXX
  -.147    4                   XXXXXXXX
   .132    5                        XXXXXXX
   .302    6                        XXXXXXXXXXXXXXXXX
   .058    7                        XXXX
   .329    8                        XXXXXXXXXXXXXXXXX
  -.042    9                      XXX
   .044   10                        XXX
   .282   11                        XXXXXXXXXXXXXXX
   .067   12                        XXXX
```

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.8.5.6. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Special Magazine Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DIMA
 SERIES 2 - PREWHITENED RECK


 MEAN OF SERIES 1      =  -.23466E-01
 ST. DEV. OF SERIES 1 =    .21759E+00
 MEAN OF SERIES 2      =  -.45980E-03
 ST. DEV. OF SERIES 2 =    .53227E+00


NUMBER OF LAGS      CROSS          NUMBER OF LAGS      CROSS
 ON SERIES 1      CORRELATION       ON SERIES 2      CORRELATION

        0             -.026              0             -.026
        1              .020              1              .218
        2             -.072              2              .101
        3             -.331              3             -.206
        4              .387              4             -.186
        5              .061              5              .217
        6             -.021              6             -.195
        7             -.016              7              .306
        8             -.249              8              .122
        9             -.212              9             -.289
       10              .089             10              .190
       11              .164             11             -.048
       12             -.035             12              .007
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

    VALUES       -1.183                0.                    1.183
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     -.064    0                        XX
      .048    1                         XX
     -.175    2                      XXXX
     -.809    3          XXXXXXXXXXXXXXXX
      .947    4                         XXXXXXXXXXXXXXXXXX
      .149    5                         XXXX
     -.052    6                        XX
     -.040    7                        XX
     -.608    8               XXXXXXXXXXX
     -.518    9                XXXXXXXXXX
      .218   10                         XXXXX
      .400   11                         XXXXXXXX
     -.086   12                        XX
   AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
   R =   0 , S =   1 AND DELAY =   3
```

Figure A.8.5.7. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Direct Mail Advertising

CROSS CORRELATIONS

SERIES 1 - PREWHITENED LOD
SERIES 2 - PREWHITENED RECK

MEAN OF SERIES 1 = .38703E+01
ST. DEV. OF SERIES 1 = .37699E+02
MEAN OF SERIES 2 = .45505E-02
ST. DEV. OF SERIES 2 = .53713E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.204	0	.204
1	.069	1	-.137
2	-.181	2	.158
3	-.137	3	-.103
4	.254	4	-.331
5	.007	5	.024
6	.007	6	.105
7	.003	7	.085
8	-.143	8	-.029
9	.167	9	.091
10	.033	10	-.047
11	.008	11	.112
12	-.144	12	.033

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-.005 0. .005
		.+++++++++.+++++++++.+++++++++.+++++++++.
.003	0	XXXXXXXXXXXXXX
.001	1	XXXXX
-.003	2	XXXXXXXXXXXX
-.002	3	XXXXXXXXXX
.004	4	XXXXXXXXXXXXXXXXX
.000	5	X
.000	6	X
.000	7	X
-.002	8	XXXXXXXXXX
.002	9	XXXXXXXXXXXX
.000	10	XXX
.000	11	XX
-.002	12	XXXXXXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.8.5.8. Cross-Correlations
Category I-IIIA Exams (Residuals from Pre-Advertising)
vs. Local Advertising

CROSS CORRELATIONS

SERIES 1 - PREWHITENED DTV2
SERIES 2 - PREWHITENED RESX

MEAN OF SERIES 1 = .32450E-01
ST. DEV. OF SERIES 1 = .27226E+00
MEAN OF SERIES 2 = .42081E-01
ST. DEV. OF SERIES 2 = .79578E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.099	0	.099
1	.387	1	.076
2	-.021	2	-.198
3	-.038	3	.127
4	.066	4	-.013
5	-.052	5	-.111
6	.141	6	.052
7	-.074	7	-.051
8	.093	8	.099
9	-.232	9	.102
10	.023	10	-.045
11	-.129	11	-.068
12	-.141	12	-.244

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
  VALUES        -1.415                0.                1.415
                  .+++++++++.+++++++++.+++++++++.+++++++++.
   .291     0                        XXXXX
  1.132     1                        XXXXXXXXXXXXXXXXX
  -.060     2                       XX
  -.110     3                      XXX
   .193     4                        XXXX
  -.151     5                      XXX
   .413     6                        XXXXXXX
  -.216     7                     XXXX
   .271     8                        XXXXX
  -.679     9              XXXXXXXXXXX
   .068    10                        XX
  -.378    11                   XXXXXX
  -.411    12                  XXXXXXX
```

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 1

Figure A.8.5.9. Cross-Correlations Category I-IIIA Exams (Residuals from Pre-Advertising) vs. TV Advertising

CROSS CORRELATIONS

SERIES 1 - PREWHITENED XMED
SERIES 2 - PREWHITENED RESX

MEAN OF SERIES 1 = -.47036E-01
ST. DEV. OF SERIES 1 = .77945E+00
MEAN OF SERIES 2 = -.16798E-02
ST. DEV. OF SERIES 2 = .49142E+00

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.157	0	.157
1	.135	1	.179
2	-.078	2	.125
3	.001	3	-.185
4	.071	4	-.233
5	.070	5	-.055
6	.211	6	-.082
7	-.117	7	.164
8	.068	8	.057
9	-.092	9	-.186
10	.067	10	-.043
11	.107	11	.006
12	.032	12	-.004

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-.166 0. .166
		.+++++++++.+++++++++.+++++++++.+++++++++.
.099	0	XXXXXXXXXXXXX
.085	1	XXXXXXXXXXX
-.049	2	XXXXXXX
.000	3	X
.045	4	XXXXXX
.044	5	XXXXXX
.133	6	XXXXXXXXXXXXXXXXX
-.074	7	XXXXXXXXXX
.043	8	XXXXXX
-.058	9	XXXXXXXX
.042	10	XXXXXX
.068	11	XXXXXXXXX
.020	12	XXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

AUTOCORRELATION FUNCTION

Figure A.8.5.10. Cross-Correlations Category I-IIIA Exams (Residuals from Pre-Advertising) vs. Total Media

Section A.8.6. How was the complete Category I-IIIA Exam model specified?

After completion of the elements of model specification, identification of the key environmental and policy co-variates and development of appropriate aggregations of the media components, we were able to structure a linear model relating exam variation to key system variables, including advertising. Multiple regression was used to estimate the parameters of a complete model specification. The resulting model specification is presented in Figure A.8.6.1.

The inclusion of advertising as a variable in the model specification did not result in any major changes in the coefficients of the non-advertising variables. In fact, only the recruiter objective variable changed in magnitude by an amount greater than 10%. This suggests that the effects of advertising are not confounded with changes in the other factors and therefore the estimated coefficients provide a good measure of the impact of changes in advertising spending levels on the number of potential recruits coming into the examination process.

The estimated impact of advertising on exam variation can be interpreted as follows:

An incremental ten thousand dollars (1978 dollars) in advertising expenditures in a given month will bring additional Category I-IIIA prospects through the examination process at the rates of

- One prospect a month for each of eight months beginning in the fourth month after the incremental expenditure, due to the long-term aggregate.
- Five additional prospects within one month of the incremental expenditure, due to the immediate response aggregate.

This estimated response model clearly demonstrates that while the flow of potential recruits into the examination process was seriously impacted by the termination of the GI Bill in 1976, and while factors within the system varied in response to changes in environmental factors and administrative policies, we could still measure a systematic response to changes in the level of advertising.

A similar analysis was done to examine the Category IIIB-IV exams, and will be discussed in the next section.

Variable	Coefficient	t statistic
. Constant	-13841	-4.4
. GI Bill	2948	8.9
. Unemployment (0-1)	366	7.1
. Recruiter Objectives	.070	3.2
. Relative Pay	6832	3.4
. Recruiters	1.05	2.4
. January	1289	4.5
. September-October	-695	-3.3
. $Adv (0 or 1)	.485	2.2
. $Adv (4-11)	.10	2.5

Durbin Watson - 1.9

R^2 .93

Figure A.8.6.1.

CAT I-IIIA Exams - Final Model

Section A.9. HOW DID THE CATEGORY IIIB-IV ANALYSIS COMPARE TO THE CATEGORY I-IIIA?

The Category IIIB-IV exam series was analyzed in the same manner as the I-IIIA series, with the following results:

- The same pre-advertising variable specification was identified (the September - October seasonal impact was marginally significant, but was included to provide for consistent structure).
- A single advertising pressure variable was identified that reflected a much shorter delay structure. The variable was a moving sum of all media for the current period through a five period lag.

The resulting model is presented in figure A.9.5.1.

The method for establishing seasonal factors, the procedure for identifying a pre-advertising model, and the analysis of the individual media was exactly the same as in developing the Category I-IIIA model, so the resulting tables and figures can be presented directly.

Table A.9.1.1 - seasonality development

Figures A.9.2.1-A.9.2.5 - non-advertising variable cross-correlations

Figure A.9.3.1 - pre-advertising model

Figures A.9.4.1-A.9.4.9 - cross-correlation of media variables

Figure A.9.5.1 - final model specification

There are two key differences in the CAT IIIB-IV exam model as compared to the I-IIIA model:

(1) The exam variation for Category IIIB-IV was much more sensitive to variation in the non-advertising factors (compare the two final models, Figure A.8.6.1 to Figure A.9.5.1). The IIIB-IV coefficients are larger for each variable.

(2) The impact of advertising showed no long-term delay, and could be specified with a variable that indicated an even distribution of the impact of changes in advertising spending from the current month through the fifth month after the change.

Section A.9.1. What Seasonality Was Found For Category IIIB-IV Exams?

Table A.9.1.1. Ratio of IIIB-IV Exams to a twelve month Moving Average for every month of Data

CATEGORY IIIB-IV EXAMS		RATIO TO MOVING AVERAGE			
	1976	1977	1978	1979	1980
JAN		1.19	1.21	1.24	1.23
FEB		.98	1.08	.94	1.15
MAR		1.06	1.00	1.01	.91
APR		.93	.79	.88	
MAY		.88	.76	.89	
JUN		1.09	1.01	1.01	
JUL		.92	.91	1.11	
AUG		.86	1.08	1.12	
SEP		.81	.94	.90	
OCT	.99	.87	.92	.97	
NOV	1.17	1.06	1.03	.96	
DEC	1.18	1.04	.95	.75	

Section A.9.2. Category IIIB-IV Exam Model Cross-Correlations with Non-advertising Factors.

```
MEAN OF SERIES 1      =  -.23981E-01
ST. DEV. OF SERIES 1 =   .11129E+01
MEAN OF SERIES 2      =  -.69739E-01
ST. DEV. OF SERIES 2 =   .19028E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.042	0	.042
1	.413	1	-.051
2	-.127	2	-.041
3	-.190	3	.122
4	-.126	4	.363
5	.199	5	.090
6	.157	6	-.210
7	-.265	7	.078
8	.078	8	-.005
9	-.106	9	-.045
10	-.006	10	.175
11	-.101	11	-.149
12	-.099	12	.141

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
    VALUES        -.882                0.                  .882
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     .071     0                        XXX
     .705     1                        XXXXXXXXXXXXXXXXXX
    -.218     2                   XXXXXX
    -.325     3                  XXXXXXXX
    -.216     4                   XXXXXX
     .341     5                        XXXXXXXXXX
     .268     6                        XXXXXXX
    -.453     7              XXXXXXXXXXX
     .133     8                        XXXX
    -.181     9                    XXXXX
    -.011    10                        X
    -.173    11                    XXXXX
    -.169    12                    XXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   1 , S =   0 AND DELAY =   1
```

Figure A.9.2.1. Cross Correlations
Cat. IIIB-IV Exams (Adjusted) vs. Youth Unemployment

CROSS CORRELATIONS

SERIES 1 - PREWHITENED FECO
SERIES 2 - PREWHITENED FEXB

MEAN OF SERIES 1 = -.12565E+00
ST. DEV. OF SERIES 1 = .18748E+01
MEAN OF SERIES 2 = .11984E-01
ST. DEV. OF SERIES 2 = .21530E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.469	0	.469
1	.275	1	.209
2	.276	2	.194
3	.393	3	.085
4	.267	4	.038
5	.233	5	-.068
6	.167	6	-.030
7	.401	7	-.055
8	.091	8	-.019
9	.238	9	-.041
10	.256	10	-.097
11	.074	11	-.024
12	.200	12	-.215

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-.673 0. .673
		.+++++++++.+++++++++.+++++++++.+++++++++.
.538	0	XXXXXXXXXXXXXXXXX
.316	1	XXXXXXXXXX
.317	2	XXXXXXXXXX
.451	3	XXXXXXXXXXXXXX
.307	4	XXXXXXXXXX
.268	5	XXXXXXXXX
.191	6	XXXXXX
.460	7	XXXXXXXXXXXXXXX
.104	8	XXXX
.273	9	XXXXXXXXX
.294	10	XXXXXXXXXX
.085	11	XXXX
.230	12	XXXXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 1 , S = 0 AND DELAY = 0

Figure A.9.2.2. Cross Correlations
Cat. IIIB-IV Exams (Adjusted) vs. Recruiter Objectives

CROSS CORRELATIONS

SERIES 1 - PREWHITENED PE1
SERIES 2 - PREWHITENED PE2B

MEAN OF SERIES 1 = -.37562E-02
ST. DEV. OF SERIES 1 = .17855E-01
MEAN OF SERIES 2 = -.22760E-01
ST. DEV. OF SERIES 2 = .18072E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.136	0	.136
1	-.079	1	-.020
2	.034	2	-.035
3	.083	3	-.037
4	-.045	4	.141
5	-.223	5	.159
6	-.123	6	.051
7	-.119	7	-.011
8	.150	8	.011
9	.077	9	.046
10	-.098	10	.001
11	-.068	11	.040
12	-.201	12	.008

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

VALUES		-28.216 0. 28.216
		.+++++++++.+++++++++.+++++++++.+++++++++.
13.733	0	XXXXXXXXXXX
-7.948	1	XXXXXXX
3.453	2	XXX
8.422	3	XXXXXXX
-4.515	4	XXXX
-22.572	5	XXXXXXXXXXXXXXXXX
-12.403	6	XXXXXXXXXX
-12.095	7	XXXXXXXXXX
15.156	8	XXXXXXXXXXXX
7.800	9	XXXXXXX
-9.900	10	XXXXXXXX
-6.931	11	XXXXXX
-20.329	12	XXXXXXXXXXXXXXX

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.9.2.3. Cross Correlations
Cat. IIIB-IV Exams (Adjusted) vs. Relative Pay

CROSS CORRELATIONS

SERIES 1 - PREWHITENED APCR
SERIES 2 - PREWHITENED PEXB

MEAN OF SERIES 1 = .12791E-01
ST. DEV. OF SERIES 1 = .82830E-01
MEAN OF SERIES 2 = .14403E+00
ST. DEV. OF SERIES 2 = .24223E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.172	0	.172
1	.172	1	-.089
2	.097	2	.090
3	.082	3	.052
4	-.240	4	-.014
5	-.126	5	.147
6	-.111	6	.093
7	.029	7	.071
8	-.026	8	-.030
9	-.038	9	.060
10	-.052	10	.068
11	.037	11	-.001
12	.163	12	.018

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
    VALUES       -8.842                0.                  8.842
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     5.075    0                        XXXXXXXXXXXX
     5.076    1                        XXXXXXXXXXXX
     2.864    2                        XXXXXXX
     2.418    3                        XXXXXX
    -7.074    4       XXXXXXXXXXXXXXXXX
    -3.700    5                XXXXXXXXX
    -3.284    6                XXXXXXXX
      .850    7                        XXX
     -.756    8                      XXX
    -1.127    9                     XXXX
    -1.532   10                     XXXX
     1.102   11                        XXX
     4.816   12                        XXXXXXXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   0 , S =   0 AND DELAY =   0
```

AUTOCORRELATION FUNCTION

Figure A.9.2.4. Cross Correlations
Cat. IIIB-IV Exams (Adjusted) vs. Recruiters

CROSS CORRELATIONS

SERIES 1 - PREWHITENED TND
SERIES 2 - PREWHITENED REXB

MEAN OF SERIES 1 = -.99990E-02
ST. DEV. OF SERIES 1 = .30140E+00
MEAN OF SERIES 2 = .62634E+00
ST. DEV. OF SERIES 2 = .26440E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.050	0	-.050
1	-.151	1	-.052
2	-.019	2	.119
3	-.191	3	.206
4	-.133	4	.253
5	-.089	5	.065
6	-.160	6	-.134

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .183

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
    VALUES      -2.099              0.                    2.099
                  .+++++++++.+++++++++.+++++++++.+++++++++.
     -.441    0                    XXXXX
    -1.321    1          XXXXXXXXXXXXXX
     -.167    2                     XXX
    -1.679    3       XXXXXXXXXXXXXXXXX
    -1.163    4            XXXXXXXXXXXX
     -.780    5                XXXXXXXX
    -1.405    6          XXXXXXXXXXXXXX
```

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

AUTOCORRELATION FUNCTION

Figure A.9.2.5. Cross Correlations
Cat. IIIB-IV Exams (Adjusted) vs. Navy Advertising

Section A.9.3. Category IIIB-IV Exams Pre-advertising Model Specifications.

VARIABLE	COEFFICIENT	"t"
Constant	-40,107	-3.5
GI Bill	5,770	-4.6
Unemployment (0-1)	715	4.5
Recruiter Objective	0.250	4.3
Relative Pay	17,561	2.4
Recruiters	443	2.8
January	3,377	4.9
September - October	-1,503	2.7
Durbin Watson	2.0	
R^2	.89	

Figure A.9.3.1. Mental Category IIIB-IV Exam Model. (Pre-Advertising) (Cochrane Orcutt Algorithm used)

Section A.9.4. Category IIB-IV Exam Model Media Analysis: Cross Correlations.

```
MEAN OF SERIES 1      =  -.22029E-01
ST. DEV. OF SERIES 1  =   .20266E+00
MEAN OF SERIES 2      =  -.33936E-01
ST. DEV. OF SERIES 2  =   .15294E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.231	0	.231
1	.201	1	-.067
2	.095	2	.154
3	.175	3	.048
4	.045	4	-.237
5	.041	5	.033
6	-.054	6	-.144
7	.054	7	-.112
8	-.227	8	-.065
9	-.020	9	-.071
10	-.161	10	-.085
11	-.204	11	-.016
12	-.098	12	.124

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
  VALUES       -2.181                0.                2.181
                 .+++++++++.+++++++++.+++++++++.+++++++++.
  1.745    0                        XXXXXXXXXXXXXXXXX
  1.513    1                        XXXXXXXXXXXXXXX
   .717    2                        XXXXXXXX
  1.323    3                        XXXXXXXXXXXXX
   .336    4                        XXXX
   .310    5                        XXXX
  -.411    6                    XXXXX
   .404    7                        XXXXX
 -1.712    8       XXXXXXXXXXXXXXXXX
  -.152    9                     XX
 -1.218   10           XXXXXXXXXXXX
 -1.542   11         XXXXXXXXXXXXXXX
  -.737   12                  XXXXXXXX
AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
R =   0 , S =   0 AND DELAY =   0
```

Figure A.9.4.1. Cross-Correlations CAT IIIB-IV Exams (Residuals from Pre-Advertising) vs. Newspaper advertising.

CROSS CORRELATIONS

SERIES 1 - PREWHITENED DR2
SERIES 2 - PREWHITENED RES2

MEAN OF SERIES 1 = .19607E+02
ST. DEV. OF SERIES 1 = .14357E+03
MEAN OF SERIES 2 = -.12933E-01
ST. DEV. OF SERIES 2 = .14992E+01

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.034	0	-.034
1	.013	1	.154
2	-.002	2	.041
3	-.170	3	-.115
4	.136	4	.123
5	.218	5	-.046
6	-.121	6	-.100
7	-.163	7	.227
8	-.128	8	-.110
9	-.078	9	-.068
10	.095	10	.202
11	.138	11	-.064
12	-.154	12	-.094

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
    VALUES        -.003                0.                  .003
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     -.000    0                       XXX
      .000    1                         XX
     -.000    2                         X
     -.002    3            XXXXXXXXXXXXX
      .001    4                         XXXXXXXXXXXX
      .002    5                         XXXXXXXXXXXXXXXXX
     -.001    6               XXXXXXXXXX
     -.002    7            XXXXXXXXXXXXX
     -.001    8               XXXXXXXXXX
     -.001    9                  XXXXXXX
      .001   10                         XXXXXXXX
      .001   11                         XXXXXXXXXXX
     -.002   12                XXXXXXXXXXXX
```

AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF THE FORM
R = 0 , S = 0 AND DELAY = 0

Figure A.9.4.2. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Radio Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DO2
 SERIES 2 - PREWHITENED PEI2


 MEAN OF SERIES 1      =  -.30537E-01
 ST. DEV. OF SERIES 1  =   .12957E+00
 MEAN OF SERIES 2      =  -.14665E+00
 ST. DEV. OF SERIES 2  =   .14139E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.209	0	.209
1	-.074	1	.044
2	-.134	2	-.058
3	-.055	3	-.010
4	-.203	4	.019
5	-.054	5	.002
6	.171	6	-.029
7	-.030	7	-.001
8	-.088	8	.025
9	.035	9	.005
10	-.155	10	.020
11	-.089	11	.014
12	.124	12	-.027

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

    VALUES       -2.853                0.                2.853
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     2.282     0                      XXXXXXXXXXXXXXXXXX
     -.803     1                  XXXXXXX
    -1.462     2               XXXXXXXXXXX
     -.599     3                  XXXXX
    -2.220     4        XXXXXXXXXXXXXXXXXX
     -.588     5                  XXXXX
     1.869     6                      XXXXXXXXXXXXXXXX
     -.325     7                   XXX
     -.962     8                XXXXXXXX
      .385     9                      XXXX
    -1.691    10            XXXXXXXXXXXXX
     -.975    11                 XXXXXXXX
     1.352    12                      XXXXXXXXXX
   AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
   R =   0 , S =   0 AND DELAY =   0
```

Figure A.9.4.3. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Outdoor Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DRG2
 SERIES 2 - PREWHITENED RES2


 MEAN OF SERIES 1      =  -.60136E-01
 ST. DEV. OF SERIES 1 =    .16578E+00
 MEAN OF SERIES 2      =  -.85815E-01
 ST. DEV. OF SERIES 2 =    .16359E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.339	0	.339
1	.272	1	.261
2	.080	2	.256
3	.377	3	.157
4	.247	4	-.170
5	.105	5	-.117
6	.026	6	-.023
7	-.035	7	-.010
8	.018	8	-.061
9	.030	9	-.075
10	-.212	10	-.148
11	-.213	11	-.088
12	-.087	12	-.005

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

     VALUES       -4.653                0.                  4.653
                    .+++++++++.+++++++++.+++++++++.+++++++++.
      3.344    0                        XXXXXXXXXXXXXXX
      2.684    1                        XXXXXXXXXXXXXX
       .790    2                        XXXX
      3.722    3                        XXXXXXXXXXXXXXXXX
      2.439    4                        XXXXXXXXXXX
      1.041    5                        XXXXX
       .252    6                        XX
      -.343    7                       XX
       .175    8                        XX
       .298    9                        XX
     -2.091   10              XXXXXXXXXX
     -2.106   11              XXXXXXXXXX
      -.858   12                   XXXXX
   AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
   R =   1 , S =   0 AND DELAY =   0
```

Figure A.9.4.4. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Reg. Magazine Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DIPS
 SERIES 2 - PREWHITENED REIS


 MEAN OF SERIES 1      =  -.30371E-01
 ST. DEV. OF SERIES 1 =    .42372E+00
 MEAN OF SERIES 2      =  -.75371E-01
 ST. DEV. OF SERIES 2 =    .16823E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.008	0	-.008
1	.048	1	-.220
2	.076	2	-.072
3	.000	3	.037
4	-.012	4	.015
5	.032	5	.066
6	.135	6	.098
7	-.108	7	.132
8	.035	8	.103
9	-.049	9	.123
10	.038	10	.142
11	.103	11	.203
12	-.113	12	.134

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

    VALUES        -.669                  0.                    .669
                   .+++++++++.+++++++++.+++++++++.+++++++++.
    -.033     0                         XX
     .190     1                          XXXXXXX
     .302     2                          XXXXXXXXXX
     .001     3                          X
    -.047     4                         XX
     .128     5                          XXXXX
     .535     6                          XXXXXXXXXXXXXXXXX
    -.429     7              XXXXXXXXXXXXXXX
     .139     8                          XXXXX
    -.194     9                    XXXXXXX
     .150    10                          XXXXX
     .411    11                          XXXXXXXXXXXXX
    -.449    12              XXXXXXXXXXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   0 , S =   0 AND DELAY =   0
```

Figure A.9.4.5. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Special Magazine Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DIMA
 SERIES 2 - PREWHITENED RESZ


 MEAN OF SERIES 1      =  -.23466E-01
 ST. DEV. OF SERIES 1  =   .21759E+00
 MEAN OF SERIES 2      =  -.41205E-01
 ST. DEV. OF SERIES 2  =   .14298E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	-.111	0	-.111
1	.149	1	.163
2	.153	2	.104
3	-.184	3	-.123
4	.229	4	.010
5	.023	5	.069
6	-.136	6	-.452
7	.040	7	.095
8	-.073	8	-.053
9	-.311	9	-.266
10	-.000	10	.202
11	-.042	11	-.027
12	-.142	12	-.147

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
   VALUES       -2.551                0.                2.551
                  .+++++++++.+++++++++.+++++++++.+++++++++.
    -.728    0                XXXXXXX
     .980    1                       XXXXXXXXXX
    1.008    2                       XXXXXXXXXX
   -1.211    3             XXXXXXXXXXX
    1.506    4                       XXXXXXXXXXXXXX
     .153    5                       XX
    -.895    6              XXXXXXXXX
     .263    7                       XXX
    -.480    8                  XXXXX
   -2.041    9       XXXXXXXXXXXXXXXXX
    -.000   10                       X
    -.278   11                   XXX
    -.934   12                XXXXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   0 , S =   0 AND DELAY =   9
```

Figure A.9.4.6. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Direct Mail Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED LCD
 SERIES 2 - PREWHITENED REC

 MEAN OF SERIES 1      =    .38703E+01
 ST. DEV. OF SERIES 1  =    .37699E+02
 MEAN OF SERIES 2      =   -.15028E+00
 ST. DEV. OF SERIES 2  =    .14467E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.035	0	.035
1	.087	1	.024
2	-.069	2	.265
3	.018	3	-.113
4	.297	4	-.166
5	.047	5	-.095
6	.171	6	.114
7	-.090	7	.086
8	-.207	8	-.198
9	.271	9	.066
10	.089	10	.058
11	-.103	11	.023
12	-.193	12	.036

APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

```
   VALUES        -.014                0.                  .014
                  .+++++++++.+++++++++.+++++++++.+++++++++.
    .001    0                        XXX
    .003    1                        XXXXXX
   -.003    2                   XXXXX
    .001    3                        XX
    .011    4                        XXXXXXXXXXXXXXXXXX
    .002    5                        XXXX
    .007    6                        XXXXXXXXXX
   -.003    7                   XXXXXX
   -.008    8              XXXXXXXXXXXX
    .010    9                        XXXXXXXXXXXXXXXXX
    .003   10                        XXXXXX
   -.004   11                  XXXXXXX
   -.007   12               XXXXXXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   0 , S =   0 AND DELAY =   0
```

Figure A.9.4.7. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Local Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED DTV2
 SERIES 2 - PREWHITENED RES2


 MEAN OF SERIES 1      =    .32450E-01
 ST. DEV. OF SERIES 1  =    .27226E+00
 MEAN OF SERIES 2      =   -.11797E+00
 ST. DEV. OF SERIES 2  =    .22001E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.036	0	.036
1	.346	1	-.205
2	-.096	2	-.205
3	-.166	3	-.040
4	-.049	4	-.103
5	-.024	5	-.119
6	.204	6	-.256
7	-.018	7	.004
8	.056	8	-.010
9	-.188	9	-.163
10	.051	10	-.031
11	.085	11	-.019
12	.034	12	-.146

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

     VALUES       -3.492                0.                    3.492
                    .+++++++++.+++++++++.+++++++++.+++++++++.
       .288     0                        XXX
      2.794     1                        XXXXXXXXXXXXXXXXXX
      -.773     2                   XXXXX
     -1.345     3                XXXXXXXXX
      -.399     4                    XXX
      -.198     5                    XX
      1.651     6                        XXXXXXXXXX
      -.147     7                    XX
       .456     8                        XXXX
     -1.519     9                XXXXXXXXXX
       .413    10                        XXX
       .685    11                        XXXXX
       .273    12                        XXX
   AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
   R =   0 , S =   0 AND DELAY =   1
```

Figure A.9.4.8. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. TV Advertising

```
CROSS CORRELATIONS

 SERIES 1 - PREWHITENED XMED
 SERIES 2 - PREWHITENED RESC


 MEAN OF SERIES 1      =  -.47036E-01
 ST. DEV. OF SERIES 1  =   .77945E+00
 MEAN OF SERIES 2      =  -.15315E+00
 ST. DEV. OF SERIES 2  =   .14274E+01
```

NUMBER OF LAGS ON SERIES 1	CROSS CORRELATION	NUMBER OF LAGS ON SERIES 2	CROSS CORRELATION
0	.089	0	.089
1	.316	1	.046
2	.094	2	.204
3	.063	3	.096
4	.101	4	.012
5	.045	5	.112
6	.114	6	-.113
7	-.099	7	.247
8	-.038	8	.091
9	-.058	9	-.063
10	-.027	10	.158
11	-.046	11	.160
12	-.119	12	.015

```
APPROXIMATE STANDARD ERROR FOR CROSS CORRELATIONS IS  .136

ESTIMATED IMPULSE RESPONSE WEIGHTS V(K)

    VALUES        -.723                0.                  .723
                   .+++++++++.+++++++++.+++++++++.+++++++++.
     .163    0                         XXXXX
     .578    1                         XXXXXXXXXXXXXXXXX
     .172    2                         XXXXXX
     .114    3                         XXXX
     .185    4                         XXXXXX
     .083    5                         XXX
     .208    6                         XXXXXXX
    -.182    7                    XXXXXX
    -.069    8                      XXX
    -.106    9                     XXXX
    -.049   10                       XX
    -.083   11                      XXX
    -.218   12                   XXXXXXX
  AUTOBJ TENTATIVELY SUGGESTS A TRANSFER MODEL OF  THE FORM
  R =   1 , S =   0 AND DELAY =   1
```

Figure A.9.4.9. Cross Correlations
Cat. IIIB-IV Exams (Residuals from Pre-Advertising)
vs. Total Media

Section A.9.5. Category IIIB-IV Exam Model: Final Model Specification

Variable	Coefficient	t statistic
. Constant	-35,781	-5.6
. GI Bill	5713	7.8
. Unemployment (0-1)	543	4.1
. Recruiter Objectives	.247	5.2
. Relative Pay	13846	3.3
. Recruiters	3.8	4.0
. January	3435	4.7
. September-October	-781	-1.5
. $ Adv (0-5)	.465	4.9

Durbin Watson - 1.6

R^2 .90

Figure A.9.5.1. Cat IIIB-IV Exams - Final Model

Final Model Specification

Section A.10. HOW WAS THE KEY PAYOFF (ACCESSIONS) RELATED TO EXAM VARIATION?

The exam models describe the response of the recruiting system to changes in advertising spending at that measurable point in the system most sensitive to the impact of advertising changes the level of ASVAB examination completions. The next step was to relate exam levels to the key pay off variable, completed accessions.

The accession process was considered for each of three degree status and test score market segments.

Since there were only two exam models (one for each test score group), we had to link each of the specific degree groups to the appropriate exam process. Figure A.10.1 outlines the structure of the linkage process.

In developing the linkage models, we had to ascertain whether the percentage of degree and non-degree accessions from each exam group is essentially fixed through time, or whether the percentage of accessions varies with changes in other factors. Since there was no available theory regarding this process, we had to identify the key issues in the linkage process, and then establish a procedure for evaluating those issues and incorporating the evaluations into a formal model of the process.

The key issues and the procedure for evaluation are discussed in the next section.

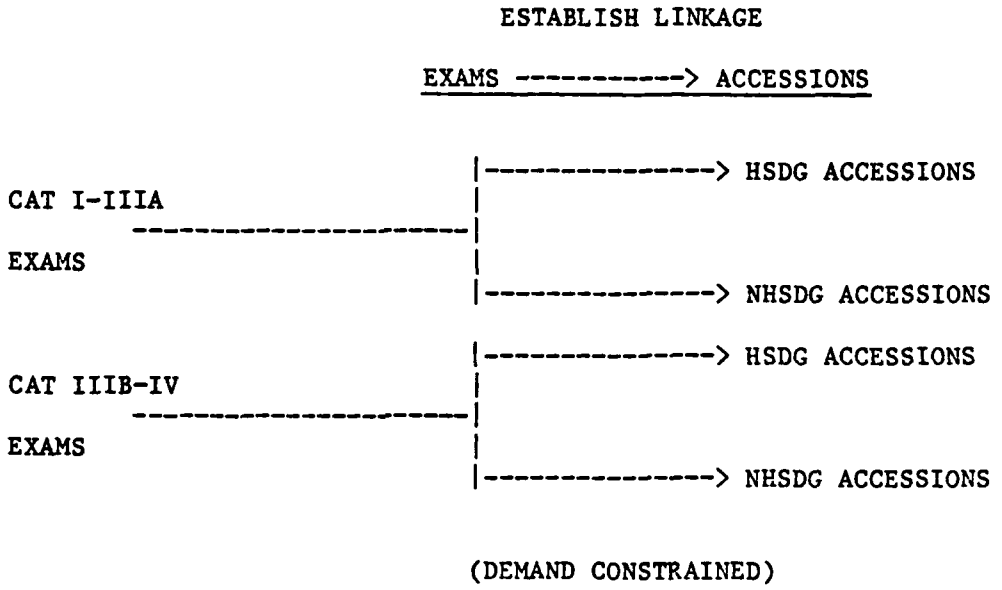

Figure A.10.1. Accessions Linkage Structure

Section A.10.1. What are the Key Issues Regarding the Linkage Between Exams and Accessions?

There were two key issues to investigate in specifying the accession linkage model:

- diminishing returns for accessions to exams, which required a non-linear model specification.
- whether variation in other system variables impacts the percentage of examined prospects who eventually enlist.

An effective way to consider the variation in the returns of accessions to exams is to examine the ratio of the two series: Accessions/Exams. This ratio will be called the conversion rate, and is defined for each market segment using the appropriate exam series.

The process that led to final linkage model specifications can best be described by the following steps:

- Examination of the patterns in the data relating to the key issues,
- Development of observations about the nature of the process based on the data, and
- Incorporation of those observations into a specific model structure.

The first step was to look at the time series of exams and accessions and to note the systematic patterns, and is described in the next section.

Section A.10.2. What did we Observe in the Time Series Relating Exams and Accessions?

Examination of the patterns relating monthly variation in exam levels to monthly variation in accession levels (see Figures A.10.2.1 - A.10.2.3) revealed the following relationshi8q[&oVwvh%©market segments under consideration. In these plots both series were transformed to a percent change from the mean value so that differences in scal- wogl% nof obscure the patterns in plotting both on the same graph.

- HSDG/Category I-IIIA - the pattern of accession variation follows closely the pattern of exam variation both in terms of long-term trend and month-to-month variation, providing evidence that changes in accession levels are closely tied to changes in exam levels (See figure A.10.2.1).

- HSDG/Category IIIB-IV - The pattern of accession variation has the same shape as the pattern of exam variation in terms of month-to-month variation, but there is a clear pattern of varying returns with respect to the long-term trend (See figure A.10.2.2). The level of exams dropped sharply from the 1976 level through 1977 to a low period in 1978 and rose through 1979 and 1980. In contrast, while the accession level dropped a little through 1977 period, it is more difficult to detect an associated increase through 1979 and 1980. These patterns suggest that accessions show a pattern of diminishing returns to increases in the level of exams.

- NON-HSDG/Category I-IIIA - The patterns in exam and accession variation are similar in month-to-month variation. The pattern in the longer term trend variation was not easily determined through inspection of the time series plots (See figure A.10.2.3).

This analysis clearly suggested that the level of accessions is largely determined by the number of candidates examined each month; however, the changing returns indicated that a multiplicative model would be appropriate.

With the basic pattern determined, we next looked at the relationship between accession levels and the conversion rate and other factors.

E	ACTUAL VALUE	FITTED VALU		F ◆=ACTUAL +=FITTED
.004	.3193	.5056		
7605	.2841	.3893	1976	
7606	.5550	.6560		
7607	.4511	.4257		
7608	.4355	.4378		
7609	.2946	.2627		
7610	.3088	.2550		
7611	.6843	.6212		
7612	.5483	.4443		
7701	.1037	.3138		
7702	.6669E-01	.2717		
7703	.1765	.3093		
7704	-.8948E-01	.5056E-01		
7705	-.1683	-.9080E-01	1977	
7706	.2186E-01	.7916E-01		
7707	.1551E-01	-.2801E-01		
7708	.2090	.2727E-01		
7709	-.6333E-01	-.1658		
7710	-.1220	-.1437		
7711	.1814	.4216E-01		
7712	.7939E-01	-.4260E-01		
7801	.1762	.1223E-01		
7802	.3493E-01	-.5999E-01		
3	.3942E-01	-.5248E-01		
4	-.2034	-.2860		
05	-.3570	-.3968		
7806	-.8126E-01	-.1719		
7807	-.1496	-.2630	1978	
7808	-.7304E-01	-.1461		
7809	-.2643	-.2988		
7810	-.2584	-.2927		
7811	-.2610	-.2070		
7812	-.2830	-.2625		
7901	.4913E-01	-.2373E-01		
7902	-.1343	-.1769		
7903	-.3914	-.1428		
7904	-.3260	-.2969		
7905	-.4203E-01	-.3010		
7906	-.4054E-01	-.2684		
7907	-.1366	-.1303		
7908	-.1328	-.1520	1979	
7909	-.3492	-.3364		
7910	-.3155	-.2696		
7911	-.2557	-.1958		
7912	-.3424	-.2675		
8001	-.2074E-01	.1703		
8002	-.2746E-01	.1900		
8003	-.1455	.6191E-02	1980	

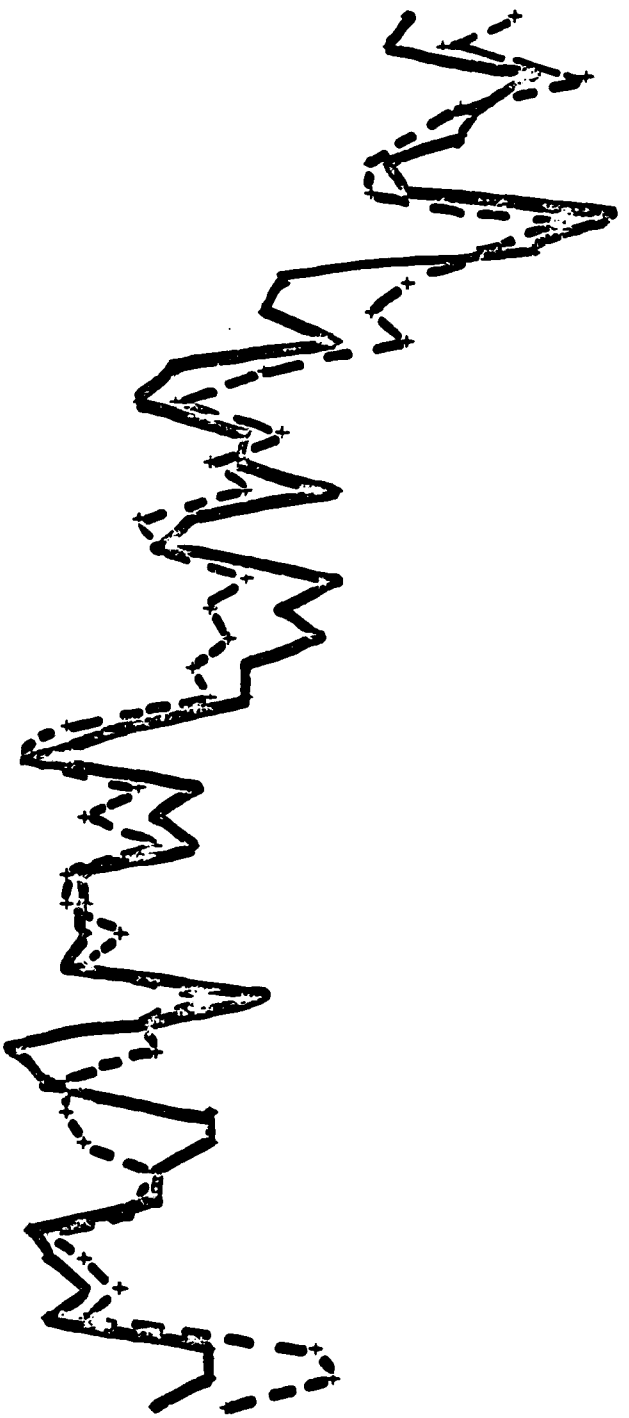

Figure A.10.2.1. HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Accessions
_ _ _Exams

DATE	ACTUAL VALUE	FITTED VALUE	
7604	-.2029	.2932	
7605	-.2139	.2343	
7606	.2737	.5574	
7607	.1640E-01	.2872	
7608	.1079	.4359	1976
7609	.1257	.4899	
7610	.9097E-01	.4171	
7611	.3634	.6552	
7612	-.2193E-01	.6366	
7701	.7909E-01	.6134	
7702	.5473E-01	.2872	
7703	.1459	.3348	
7704	-.2668E-01	.1223	
7705	-.8491E-01	.3147E-02	
7706	.1884	.1780	1977
7707	.1269	-.7087E-01	
7708	.2172	-.1726	
7709	.3868E-01	-.2500	
7710	-.7303E-01	-.2398	
7711	.2342	-.1134	
*2	.1453	-.1643	
1	.2410	-.6529E-01	
J2	.5770E-01	-.1787	
7803	.1201	-.2460	
7804	-.1500	-.4093	
7805	-.2213	-.4393	
7806	.1085	-.2627	1978
7807	-.6352E-01	-.3387	
7808	.7285E-01	-.2178	
7809	-.2906E-01	-.3185	
7810	-.9412E-01	-.3294	
7811	-.8164E-01	-.2322	
7812	-.1030	-.2780	
7901	.1415	-.3814E-01	
7902	-.9739E-01	-.2504	
7903	-.3496	-.1781	
7904	-.2917	-.2705	
7905	.5978E-01	-.2458	
7906	.1855	-.1334	
7907	.2858E-01	-.2914E-01	1979
7908	.5621E-01	.1155E-01	
7909	-.1562	-.1615	
7910	-.1687	-.8344E-01	
7911	-.1678	-.7154E-01	
7912	-.3639	-.2522	
0001	-.3500E-01	.2780	
?	-..024	.2251	1980
3	-.1815	-.1910E-01	

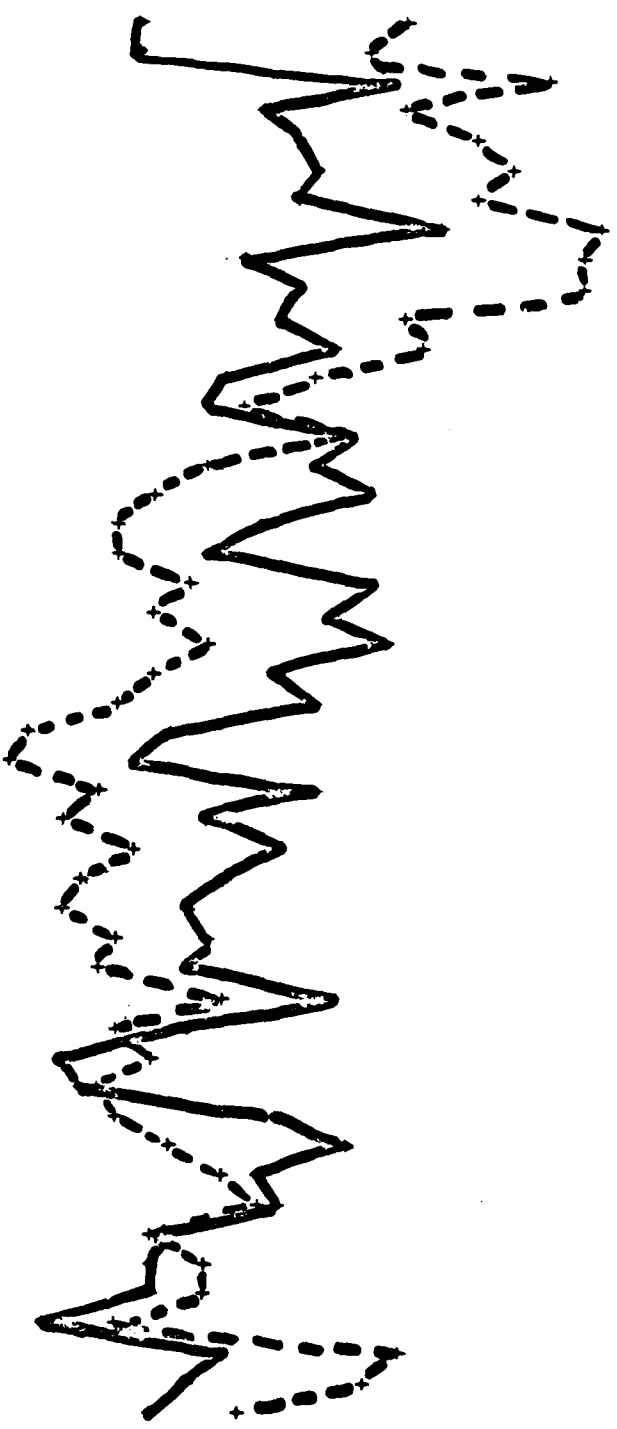

Figure A.10.2.2. HSDG/CAT IIIB-IV
(% Deviation from Mean)
_____Accessions
_ _ _Exams

DATE	ACTUAL VALUE	FITTED VALUE
7604	.7481	.5056
7605	.6687	.3893
7606	.6138	.6560
7607	.4232	.4257
7608	.5276	.4378
7609	.3826	.2627
7610	.3208	.2550
7611	.4476	.6212
7612	.5582	.4443
7701	.2633	.3138
7702	.1858	.2717
7703	.2039	.3093
7704	.8209E-01	.5056E-01
7705	.1649E-01	-.9080E-01
7706	-.7347E-01	.7916E-01
7707	-.4558	-.2801E-01
7708	-.6932	.2737E-01
7709	-.7101	-.1658
7710	-.5427	-.1437
1	-.3721	.4216E-01
2	-.2328	-.4260E-01
31	-.4723E-01	.1223E-01
7802	.2499E-03	-.5999E-01
7803	-.2478	-.5248E-01
7804	-.4127	-.2860
7805	-.3209	-.3968
7806	-.2190	-.1719
7807	-.2347	-.2630
7808	-.7097E-01	-.1461
7809	-.2028	-.2988
7810	-.2065	-.2927
7811	-.2472	-.2070
7812	-.3509	-.2625
7901	-.8722E-01	-.2373E-01
7902	-.2359	-.1769
7903	-.4433	-.1428
7904	-.2578	-.2969
7905	.6210E-01	-.3010
7906	-.2259	-.2684
7907	-.2786E-01	-.1303
7908	.8459E-01	-.1520
7909	-.6098E-01	-.3364
7910	.1837E-01	-.2696
7911	.1190	-.1958
7912	-.1474E-01	-.2675
1	.5388	.1703
2	.5188	.1900
8003	.2114	.6191E-02

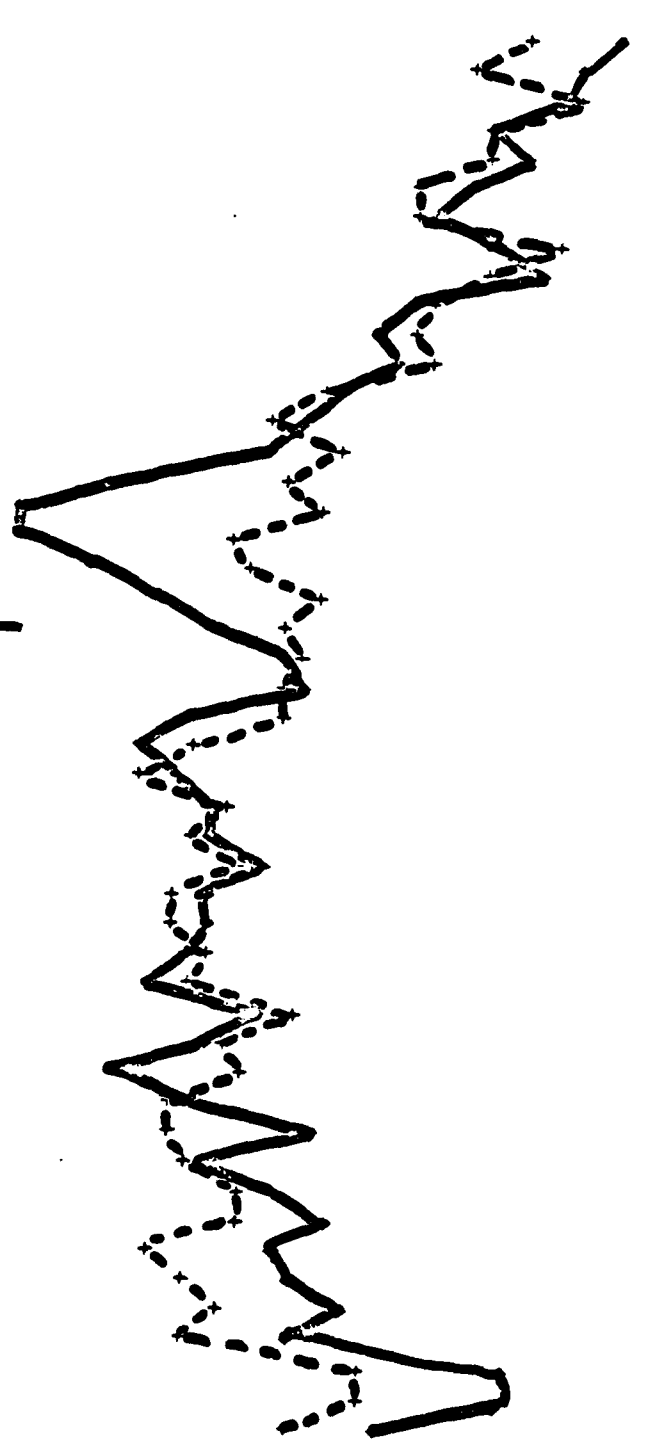

Figure A.10.2.3. Non-HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Accessions
_ _ _ Exams

Section A.10.3. What Factors had a Major Impact on the Conversion Rate?

In the preceding section, we observed a pattern that suggested that accessions varied in the same direction as exams; however, in order to determine if accessions varied at the same rate as exams or whether there was a pattern of differing rates, we looked at the ratio of accessions to exams to see if there was any systematic pattern in the varying rates. We called this ratio the conversion rate.

For all three market segments, the conversion rates varied inversely with the level of exams (See figures A.10.5.1 - A.10.5.3.), and was particularly strong for the HSDG/Category IIIB-IV segment. This inverse relationship suggested that either the capacity of the system to absorb increased exams was not as flexible as the capacity to generate the exams, or that conflicting administrative policies were often at work that led to increases in the number people pulled into the examining system beyond the accession needs for these groups. This variation in the conversion rate pinpoints the differences in exam and accession dynamics, and highlights the need for the two-stage description of the system. The varying conversion rates led to the conclusion that an elasticity form of model relating the percentage change in accessions to the percentage change in exams would be appropriate and that we would expect elasticities between zero and one. With the basic form of the model clearly in mind, we looked to see what factors impacted variation in the conversion rate. Of primary concern was the variation in manpower needs, which is examined in the next section.

...TE	ACTUAL VALUE	FITTED VALUE	PLOT	◆=ACTUAL	+=FITTED
7604	-.1357	.5056			
7605	-.8833E-01	.3893			
7606	-.7379E-01	.6560			
7607	.3929E-02	.4257			
7608	-.1528E-01	.4378	1976		
7609	.1127E-01	.2627			
7610	.2860E-01	.2550			
7611	.2473E-01	.6212			
7612	-.2138	.4443			
7701	-.1714	.3138			
7702	-.1727	.2717			
7703	-.1137	.3093			
7704	-.1452	.5056E-01			
7705	-.9776E-01	-.9080E-01			
7706	-.6604E-01	.7916E-01	1977		
7707	.3048E-01	-.2801E-01			
7708	.1609	.2727E-01			
7709	.1075	-.1658			
7710	.1136E-01	-.1437			
7711	.1181	.4216E-01			
7712	.1120	-.4260E-01			
01	.1461	.1223E-01			
02	.8593E-01	-.5999E-01			
03	.8199E-01	-.5248E-01			
7804	.1003	-.2860			
7805	.5144E-01	-.3968			
7806	.9425E-01	-.1719	1978		
7807	.1380	-.2630			
7808	.7069E-01	-.1461			
7809	.3479E-01	-.2988			
7810	.3429E-01	-.2927			
7811	-.8086E-01	-.2070			
7812	-.4108E-01	-.2625			
7901	.5994E-01	-.2373E-01			
7902	.3734E-01	-.1769			
7903	-.2997	-.1428			
7904	-.5451E-01	-.2969			
7905	.3518	-.3010			
7906	.2936	-.2684	1979		
7907	-.2076E-01	-.1303			
7908	.8604E-02	-.1520			
7909	-.3265E-01	-.3364			
7910	-.7568E-01	-.2696			
7911	-.8724E-01	-.1958			
7912	-.1145	-.2675			
8001	-.1746	.1703			
02	-.1939	.1900			
3	-.1624	.6191E-02	1980		

Figure A.10.3.1. HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Conversion Rate
_ _ _Exams

DATE	ACTUAL VALUE	FITTED VALUE	
7604	-.4220	.2933	
7605	-.4027	.2343	
7606	-.2330	.5574	
7607	-.2595	.2872	1976
7608	-.2764	.4359	
7609	-.2914	.4900	
7610	-.2780	.4171	
7611	-.2276	.6553	
7612	-.4396	.6367	
7701	-.3728	.6135	
7702	-.2316	.2872	
7703	-.1949	.3348	
7704	-.1867	.1224	
7705	-.1446	.3199E-02	
7706	-.5397E-01	.1781	
7707	.1374	-.7082E-01	1977
7708	.3795	-.1725	
7709	.2987	-.2500	
7710	.1435	-.2398	
7711	.3054	-.1134	
7712	.2852	-.1642	
01	.2451	-.6524E-01	
2	.2077	-.1787	
03	.3930	-.2459	
7804	.3495	-.4093	
7805	.3024	-.4393	
7806	.4099	-.2627	
7807	.3279	-.3386	1978
7808	.2862	-.2178	
7809	.3361	-.3185	
7810	.2667	-.3293	
7811	.1217	-.2322	
7812	.1650	-.2779	
7901	.1129	-.3809E-01	
7902	.1291	-.2503	
7903	-.2580	-.1780	
7904	-.8954E-01	-.2704	
7905	.3178	-.2458	
7906	.2828	-.1334	
7907	-.6491E-02	-.2909E-01	1979
7908	-.2084E-01	.1161E-01	
7909	-.5636E-01	-.1614	
7910	-.1495	-.8340E-01	
7911	-.1595	-.7149E-01	
7912	-.2024	-.2521	
8001	-.2919	.2781	
8002	-.3130	.2252	1980
3	-.2175	-.1904E-01	

Figure A.10.3.2. HSDG/CAT IIIB-IV
(% Deviation from Mean)
_____Conversion Rate
_ _ _Exams

DATE	ACTUAL VALUE	FITTED VALUE	
7604	.1559	.5056	
7605	.1958	.3893	
7606	-.2984E-01	.6560	
7607	-.6223E-02	.4257	
7608	.5766E-01	.4378	1976
7609	.9007E-01	.2627	
7610	.4767E-01	.2550	
7611	-.1111	.6212	
7612	.7402E-01	.4443	
7701	-.4279E-01	.3138	
7702	-.7170E-01	.2717	
7703	-.8458E-01	.3093	
7704	.2540E-01	.5056E-01	
7705	.1130	-.9080E-01	
7706	-.1453	.7916E-01	1977
7707	-.4427	-.2801E-01	
7708	-.7027	.2727E-01	
7709	-.6540	-.1658	
7710	-.4683	-.1437	
7711	-.4002	.4216E-01	
7712	-.2022	-.4260E-01	
7801	-.6297E-01	.1223E-01	
7802	.5932E-01	-.5999E-01	
7803	-.2097	-.5248E-01	
7804	-.1812	-.2860	
7805	.1208	-.3968	
7806	-.6119E-01	-.1719	
7807	.3376E-01	-.2630	
7808	.8308E-01	-.1461	1978
7809	.1318	-.2988	
7810	.1169	-.2927	
7811	-.5495E-01	-.2070	
7812	-.1237	-.2625	
7901	-.6922E-01	-.2373E-01	
7902	-.7587E-01	-.1769	
7903	-.3535	-.1428	
7904	.5087E-01	-.2969	
7905	.5127	-.3010	
7906	.5336E-01	-.2684	
7907	.1128	-.1303	
7908	.2732	-.1520	1979
7909	.4087	-.3364	
7910	.3880	-.2696	
7911	.3851	-.1958	
7912	.3391	-.2675	
8001	.3090	.1703	
8002	.2706	.1900	
8003	.1900	.6191E-02	1980

Figure A.10.3.3.
Non-HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Conversion Rate
_ _ _ Exams

Section A.10.4. How do Variations in Manpower Needs Impact Conversion Rate Variation?

It was reasonable to expect that variation in the level of manpower needs would be a key determinant of the variation in the conversion rate.

The recruiter objective variable measuring monthly accession objectives, which was the only available quantitative measure of manpower needs, was transformed to express objectives in the following manner:

(1) long-term objectives - twelve month moving average of objectives, which reflects the overall mission level.

(2) short-term objectives - the ratio of monthly objectives to the smoothed series, which captures variation in the monthly emphases in the annual mission.

The impact of varying objectives on the returns of accessions to exams was investigated by comparing both the long- and short-term objective series with each conversion rate series (accessions/exams).

See Figures A.10.4.1 - A.10.4.3 for a comparison to long-term objectives, and Figures A.10.4 - A.10.6 for a comparison to short-term objectives.

Three key observations resulted from this examination:

- The conversion rate varies inversely with the level of long-term objectives for both of the high school degree status market segments, CAT I-IIIA and CAT IIIB-IV (See Figures A.10.4.1 and A.10.4.2).

- The conversion rate varies directly (but weakly) with the level of short-term objectives for both of the high school degree market segments (See Figures A.10.4.4 and A.10.4.5).

- The conversion rate varies independently of the level of both the long- and short-term objectives for the Non-Degree/ Category I-IIIA segment (See Figures A.10.4.3 and A.10.4.6).

Pressure brings people into the exam process at a faster rate than they are converted to accessions. It was clear from these observations that "pressure" on the recruiting system (long-term objectives reflecting annual mission levels) had differing impacts on the number of prospects brought into the process through the examination stage and on the number of those prospects who eventually enlist into the Army.

This pattern suggested that during periods of higher pressure, relative priorities for accessions shifted from these segments to the less supply-constrained segment, thereby surfacing as a lowering of the conversion ratio.

These observations indicated that since the two objective specifications had impacts in differing directions, that both should be included in the model specifications.

	ACTUAL VALUE	FITTED VALUE	
			PLOT ◆=ACTUAL +=FITTED
7604	-.1357	.2386	
7605	-.8833E-01	.2479	
7606	-.7379E-01	.2490	
7607	.3929E-02	.2402	1976
7608	-.1528E-01	.2311	
7609	.1127E-01	.2239	
7610	.2860E-01	.2221	
7611	.2473E-01	.2199	
7612	-.2138	.1990	
7701	-.1714	.1839	
7702	-.1727	.1718	
7703	-.1137	.1387	
7704	-.1452	.9808E-01	
7705	-.9776E-01	.5187E-01	
7706	-.6604E-01	.1634E-01	1977
7707	.3048E-01	-.1760E-01	
7708	.1609	-.5329E-01	
7709	.1075	-.8397E-01	
7710	.1136E-01	-.1187	
7711	.1181	-.1500	
7712	.1120	-.1668	
7801	.1461	-.1746	
7802	.8593E-01	-.1761	
03	.8199E-01	-.1637	
04	.1003	-.1540	
05	.5144E-01	-.1571	
7806	.9425E-01	-.1601	1978
7807	.1380	-.1573	
7808	.7069E-01	-.1548	
7809	.3479E-01	-.1521	
7810	.3429E-01	-.1274	
7811	-.8086E-01	-.8999E-01	
7812	-.4108E-01	-.6312E-01	
7901	.5994E-01	-.3815E-01	
7902	.3734E-01	-.2432E-01	
7903	-.2997	-.2578E-01	
7904	-.5451E-01	-.2697E-01	
7905	.3518	-.2697E-01	
7906	.2936	-.2697E-01	1979
7907	-.2076E-01	-.2697E-01	
7908	.8604E-02	-.2697E-01	
7909	-.3265E-01	-.2697E-01	
7910	-.7568E-01	-.2697E-01	
7911	-.8724E-01	-.2697E-01	
7912	-.1145	-.2697E-01	
8001	-.1746	-.2697E-01	
8002	-.1939	-.2697E-01	
8003	-.1624	-.2697E-01	1980

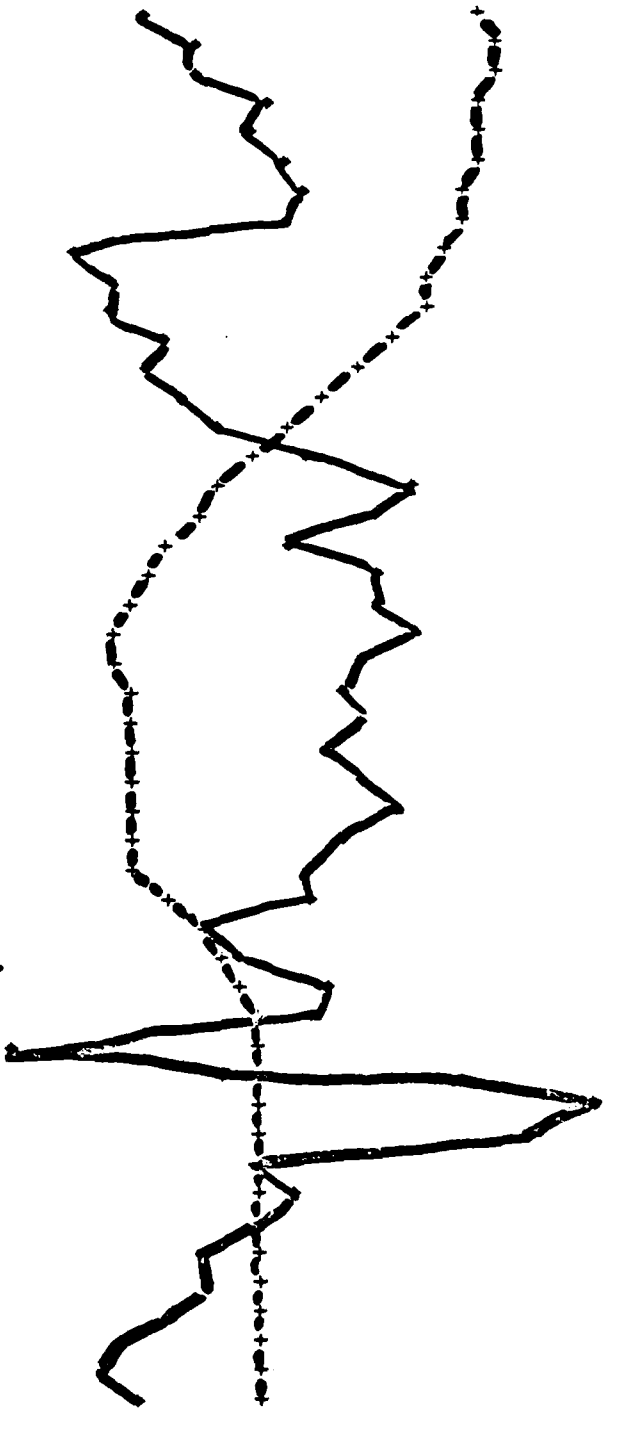

Figure A.10.4.1. HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Conversion Rate
_ _ _ Long Term Objectives

ATE	ACTUAL VALUE	FITTED VALUE
7604	-.422	.2386
7605	-.4027	.2479
7606	-.3330	.2490
7607	-.2595	.2402
7608	-.2764	.2311
7609	-.2914	.2239
7610	-.2780	.2221
7611	-.2276	.2199
7612	-.4396	.1990
7701	-.3728	.1839
7702	-.2316	.1718
7703	-.1949	.1387
7704	-.1867	.9808E-01
7705	-.1446	.5187E-01
7706	-.5397E-01	.1634E-01
7707	.1374	-.1760E-01
7708	.3795	-.5329E-01
7709	.2987	-.8397E-01
7710	.1435	-.1187
7711	.3054	-.1500
7712	.2852	-.1668
[illegible]01	.2451	-.1746
[illegible]02	.2077	-.1761
[illegible]03	.3930	-.1637
7804	.3495	-.1540
7805	.3024	-.1571
7806	.4099	-.1601
7807	.3279	-.1573
7808	.2862	-.1548
7809	.3361	-.1521
7810	.2667	-.1274
7811	.1217	-.8999E-01
7812	.1650	-.6312E-01
7901	.1129	-.3815E-01
7902	.1291	-.2432E-01
7903	-.2580	-.2578E-01
7904	-.8954E-01	-.2697E-01
7905	.3178	-.2697E-01
7906	.2828	-.2697E-01
7907	-.6491E-02	-.2697E-01
7908	-.2084E-01	-.2697E-01
7909	-.5636E-01	-.2697E-01
7910	-.1495	-.2697E-01
7911	-.1595	-.2697E-01
7912	-.2024	-.2697E-01
8001	-.2919	-.2697E-01
8002	-.3130	-.2697E-01
[illegible]03	-.2175	-.2697E-01

PLOT ◆=ACTUAL +=FITTED

Figure A.10.4.2. HSDG/CAT IIIB-IV
(% Deviation from Mean)
_____Conversion Rate
_ _ _ Long Term Objectives

ATE	ACTUAL VALUE	FITTED VALUE	
7604	.1559	.2386	
7605	.1958	.2479	
7606	-.2984E-01	.2490	
7607	-.6223E-02	.2402	
7608	.5766E-01	.2311	1976
7609	.9007E-01	.2239	
7610	.4767E-01	.2221	
7611	-.1111	.2199	
7612	.7402E-01	.1990	
7701	-.4279E-01	.1839	
7702	-.7170E-01	.1718	
7703	-.8458E-01	.1387	
7704	.2540E-01	.9808E-01	
7705	.1130	.5187E-01	
7706	-.1453	.1634E-01	1977
7707	-.4427	-.1760E-01	
7708	-.7027	-.5329E-01	
7709	-.6540	-.8397E-01	
7710	-.4683	-.1187	
7711	-.4002	-.1500	
7712	-.2022	-.1668	
11	-.6297E-01	-.1746	
2	.5932E-01	-.1761	
03	-.2097	-.1637	
7804	-.1812	-.1540	
7805	.1208	-.1571	
7806	-.6119E-01	-.1601	1978
7807	.3376E-01	-.1573	
7808	.8308E-01	-.1548	
7809	.1318	-.1521	
7810	.1169	-.1274	
7811	-.5495E-01	-.8999E-01	
7812	-.1237	-.6312E-01	
7901	-.6922E-01	-.3815E-01	
7902	-.7587E-01	-.2432E-01	
7903	-.3535	-.2578E-01	
7904	.5087E-01	-.2697E-01	
7905	.5127	-.2697E-01	
7906	.5336E-01	-.2697E-01	1979
7907	.1128	-.2697E-01	
7908	.2732	-.2697E-01	
7909	.4087	-.2697E-01	
7910	.3880	-.2697E-01	
7911	.3851	-.2697E-01	
7912	.3391	-.2697E-01	
8001	.3090	-.2697E-01	
8002	.2706	-.2697E-01	
3	.1986	-.2697E-01	1980

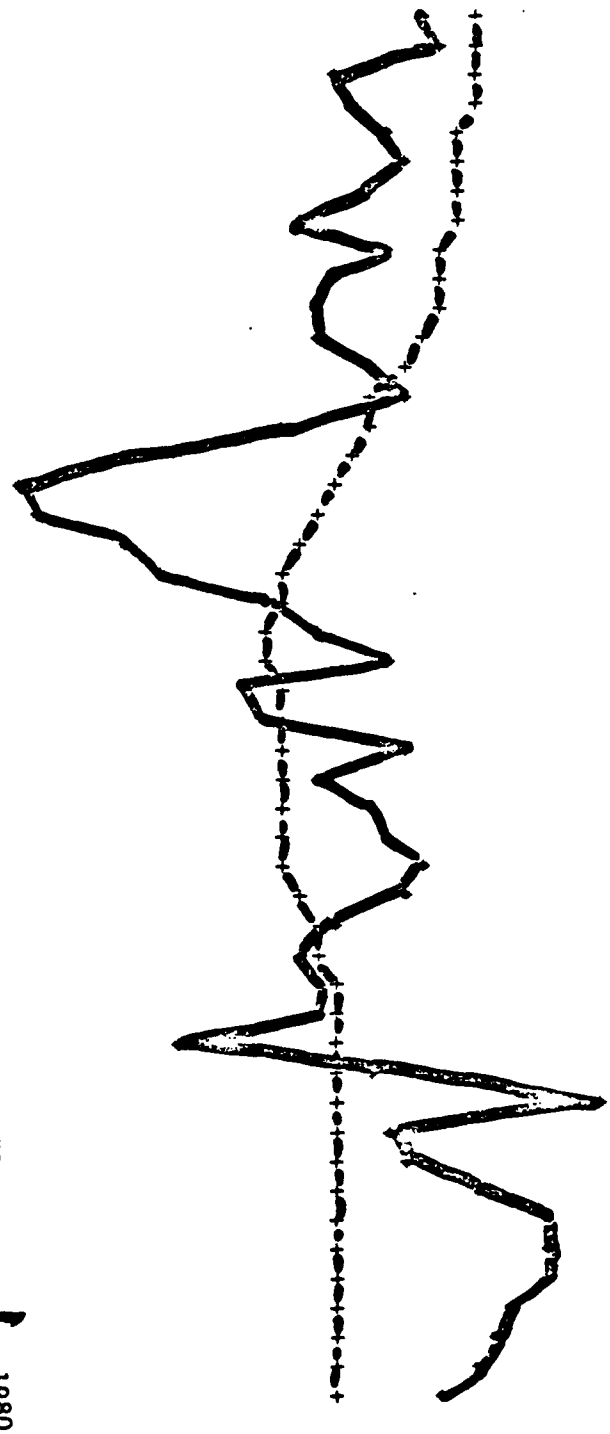

Figure A.10.4.3. Non-HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Conversion Rate
_ _ _ Long Term Objectives

DATE	ACTUAL VALUE	FITTED VALUE
7604	-.1270	-.3159
7605	.7912E-01	-.2163
7606	- 6444E-01	.5549
7607	.1407E-01	.5314E-01
7608	-.5329E-02	.3113
7609	.2148E-01	.3352
7610	.3899E-01	.4190E-01
7611	.3509E-01	.3225E-01
7612	-.2059	-.4356
7701	-.1631	.1058
7702	-.1643	-.6394E-01
7703	-.1047	-.1634
7704	-.1365	-.2303
7705	-.8865E-01	-.1212
7706	-.5661E-01	.4644
7707	.4089E-01	.4164
7708	.1726	.3034
7709	.1187	.3201
10	.2158E-01	-.1970
1	.1294	-.1779
12	.1232	-.5541
7801	.1576	-.4619E-01
7802	.9690E-01	-.9062E-01
7803	.9291E-01	-.3389
7804	.1114	-.5284
7805	.6206E-01	-.2780
7806	.1053	.6587
7807	.1495	.5393
7808	.8150E-01	.5280
7809	.4524E-01	.7140
7810	.4473E-01	-.1965
7811	-.7157E-01	-.3073
7812	-.3139E-01	-.6084
7901	.7065E-01	-.1060
7902	.4782E-01	-.2443
7903	-.2926	-.3528
7904	-.4496E-01	-.5308E-01
7905	.3654	.2637E-01
7906	.3066	.7039
7907	-.1087E-01	.6862
7908	.1879E-01	.3207
7909	-.2288E-01	.4636
7910	- 6634E-01	-.2794
7911	- 7802E-01	-.3522
2	-.1056	-.6229
1	-.1663	-.1163
02	-.1858	-.2423
8003	-.1539	-.3520

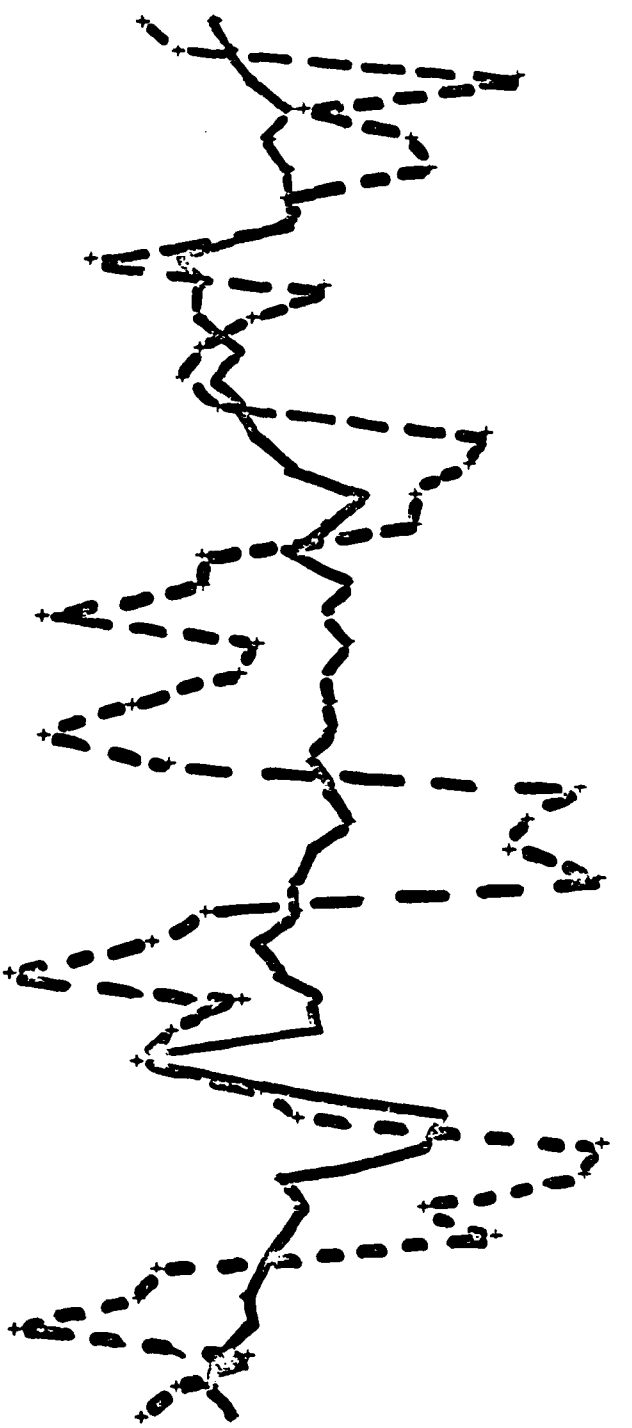

Figure A.10.4.4. HSDG/CAT I-IIIA
(% Deviation from Mean)
_____Conversion Rate
_ _ _ _Short Term Objectives

DATE	ACTUAL VALUE	FITTED VALUE
7604	-.4220	-.3159
7605	-.4027	-.2163
7606	-.2338	.5549
7607	-.2595	.5314E-01
7608	-.2764	.3113
7609	-.2914	.3352
7610	-.2780	.4190E-01
7611	-.2276	.3225E-01
7612	-.4396	-.4356
7701	-.3728	.1058
7702	-.2316	-.6394E-01
7703	-.1949	-.1634
7704	-.1867	-.2303
7705	-.1446	-.1212
7706	-.5397E-01	.4644
7707	.1374	.4164
7708	.3795	.3034
7709	.2987	.3201
'0	.1435	-.1970
1	.3054	-.1779
12	.2852	-.5541
7801	.2451	-.4619E-01
7802	.2077	-.9062E-01
7803	.3930	-.3389
7804	.3495	-.5284
7805	.3024	-.2780
7806	.4099	.6587
7807	.3279	.5393
7808	.2862	.5280
7809	.3361	.7140
7810	.2667	-.1965
7811	.1217	-.3073
7812	.1650	-.6084
7901	.1129	-.1060
7902	.1291	-.2443
7903	-.2580	-.3528
7904	-.8954E-01	-.5308E-01
7905	.3178	.2637E-01
7906	.2828	.7039
7907	-.6491E-02	.6862
7908	-.2084E-01	.3207
7909	-.5636E-01	.4636
7910	-.1495	-.2794
'11	-.1595	-.3522
2	-.2024	-.6229
J1	-.2913	-.1163
J002	-.3130	-.2423
8003	-.2175	-.3520

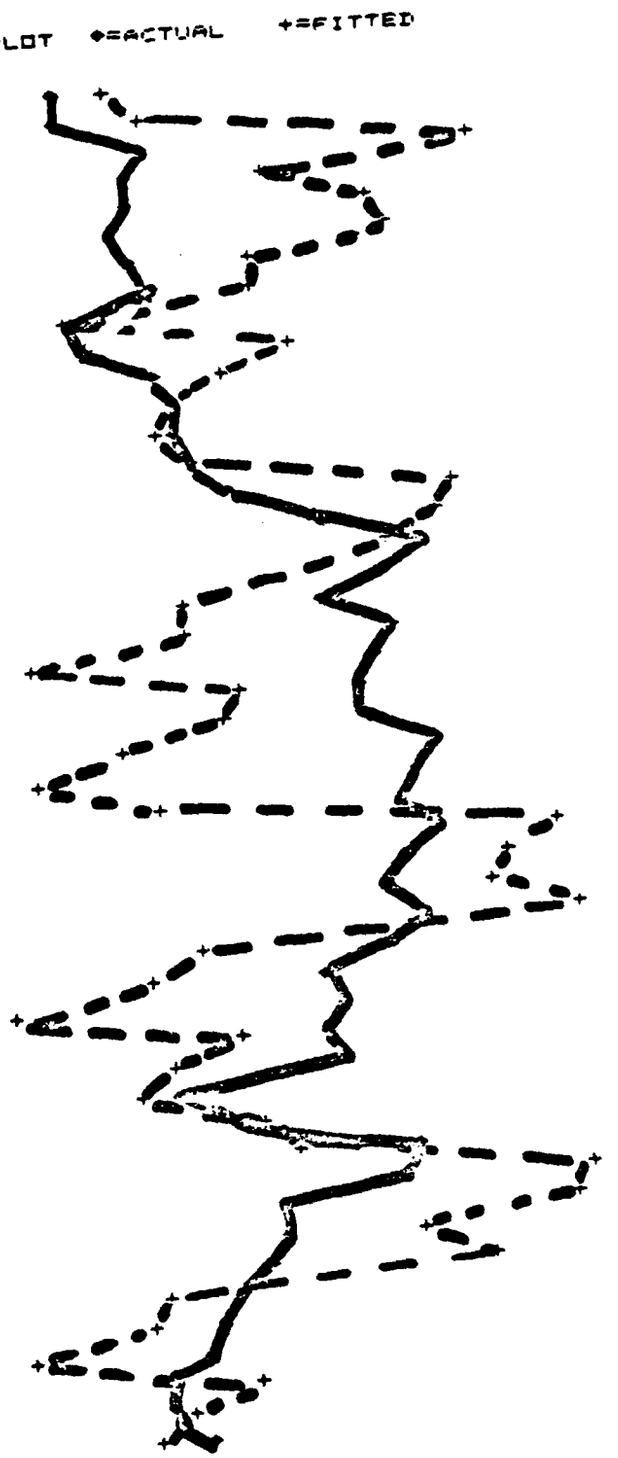

Figure A.10.4.5. HSDG/CAT IIIB-IV
(% Deviation from Mean)
_____Conversion Rate
– – –Short Term Objectives

DATE	ACTUAL VALUE	FITTED VALUE
7604	.1559	-.3159
7605	.1958	-.2163
7606	-.2984E-01	.5549
7607	-.6223E-02	.5314E-01
7608	.5766E-01	.3113
7609	.9007E-01	.3352
7610	.4767E-01	.4190E-01
7611	-.1111	.3225E-01
7612	.7402E-01	-.4356
7701	-.4279E-01	.1058
7702	-.7170E-01	-.6394E-01
7703	-.8458E-01	-.1634
7704	.2540E-01	-.2303
7705	.1130	-.1212
7706	-.1453	.4644
7707	-.4427	.4164
7708	-.7027	.3034
09	-.6540	.3201
0	-.4683	-.1970
11	-.4002	-.1779
7712	-.2022	-.5541
7801	-.6297E-01	-.4619E-01
7802	.5932E-01	-.9062E-01
7803	-.2097	-.3389
7804	-.1812	-.5284
7805	.1208	-.2780
7806	-.6119E-01	.6587
7807	.3376E-01	.5393
7808	.8308E-01	.5280
7809	.1318	.7140
7810	.1169	-.1965
7811	-.5495E-01	-.3073
7812	-.1237	-.6084
7901	-.6922E-01	-.1060
7902	-.7587E-01	-.2443
7903	-.3535	-.3528
7904	.5087E-01	-.5308E-01
7905	.5127	.2637E-01
7906	.5336E-01	.7039
7907	.1128	.6862
7908	.2732	.3207
7909	.4087	.4636
7910	.3880	-.2794
11	.3851	-.3522
12	.3391	-.6229
8001	.3090	-.1163
8002	.2706	-.2423
8003	.1986	-.3520

PLOT +=ACTUAL +=FITTED

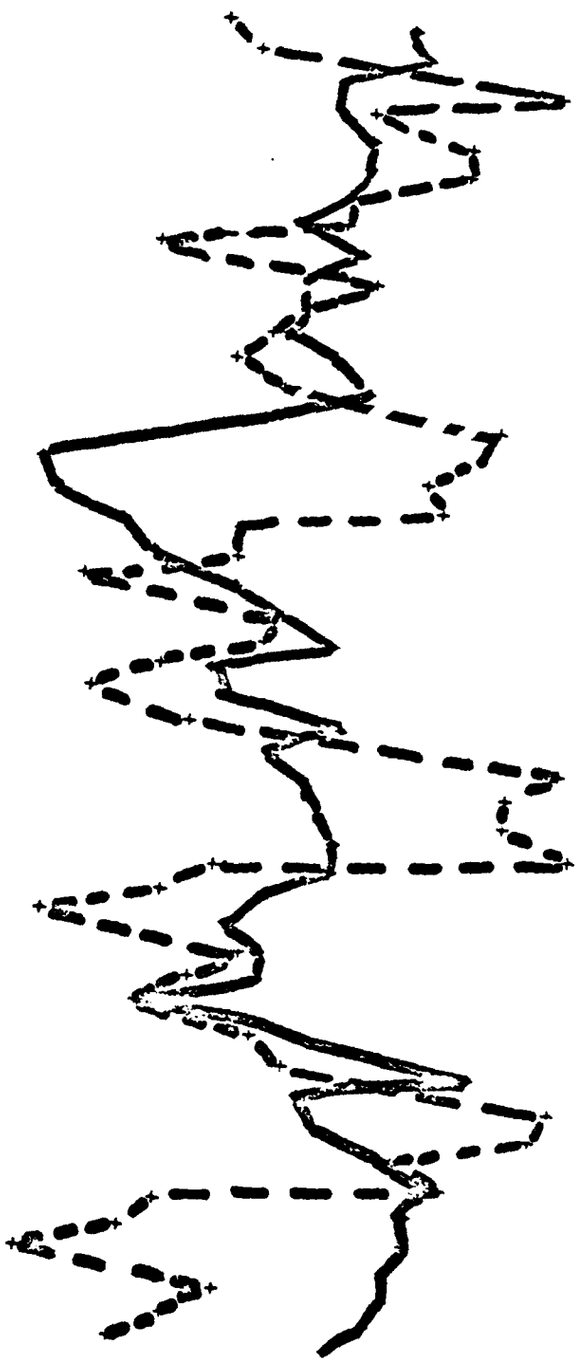

Figure A.10.4.6. NHSDG/CAT I-IIIA
(% Deviation from Mean)
_____Conversion Rate
– – – Short Term Objectives

Section A.10.5. Do Other Factors Impact the Conversion Rate?

The level of exams and manpower needs have been identified as the key determinants of the conversion rate. The remaining question requiring investigation was whether changes in other factors impacted the types of individuals drawn into the examination process, and therefore had an effect on the conversion rate.

We would expect that the impact on accession and conversion rate variation due to changes in the environmental and policy variables (other than objectives) would be reflected through exam variation in the first stage of the process. We would not expect that variation in these variables would impact the mix of candidates as well as the level of exams to a degree that would require their inclusion in the second stage of the process. The structure of this hypothesis is outlined in Figure A.10.5.1.

The hypothesis that no additional variables impacted accessions independently of their impact on exams was tested in the following manner: for each accession series a multiple regression model was specified to include

- level of exams
- objectives
  - short term
  - long term
- unemployment
- production recruiters
- GI bill
- Seasonal Dummies
  - Jan.
  - Sept. - Oct.
- Relative pay
- Advertising variables

Because of the complexity of the model specification, the hypothesis of variable intervention in the determination of accessions was rejected unless there was strong evidence to the contrary (t-statistics over 3.0). The estimated regression equations for each of the three accession market segments are presented in Figures A.10.5.2 - A.10.5.4.

Even though the GI Bill variable did not meet the strict criterion of t greater than 30, we had strong graphic evidence of an impact on the conversion rate on the Category I-IIIA group because of the sharp drop in the conversion rate immediately after termination (See Figure A.10.4.1).

This factor was included and its significance verified in the final model estimation (See figure A.10.6.1).

There was a depression in the conversion rate for the HSDG/Category I-IIIA group after termination of the GI Bill.

No other factors are key determinants of the accession rate for the other two groups.

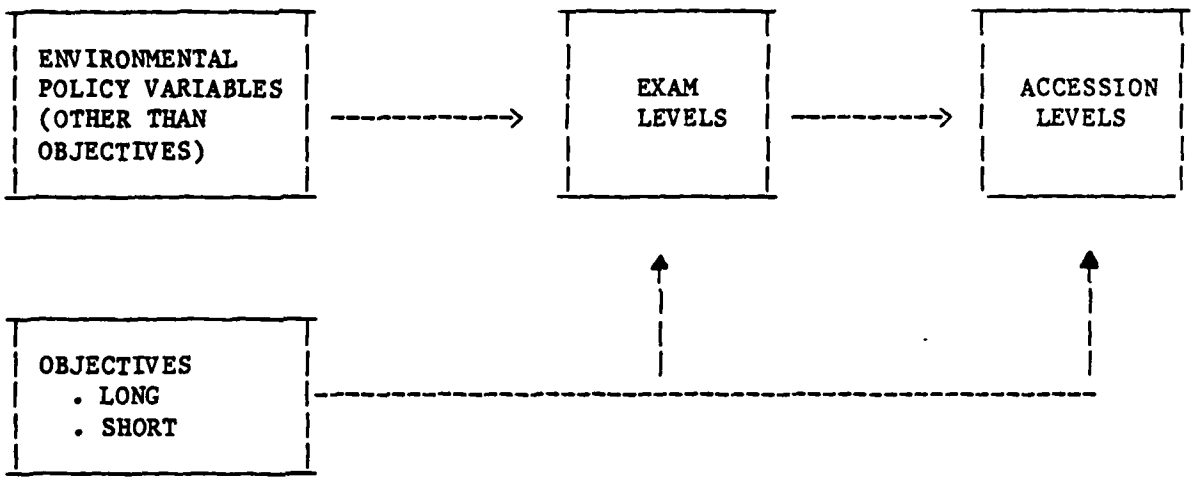

Figure A.10.5.1. Direction of Impacts of Impacts in Two-Stage Process

REGRESSION 1

Dependent variable: HSDG/CAT I-IIIA Accessions (logarithm)

Right-hand Variable (logarithm)	Estimated Coefficient	T-Statistic
CONSTANT	3.54	.937
EXAMS CAT I-IIIA	.602	3.28
LONG TERM OBJECTIVES	-.735	-3.51
SHORT TERM OBJECTIVES	.151	3.01
UNEMPLOYMENT	.221	.810
RELATIVE PAY	.965	2.46
RECRUITERS	.808	1.57
GI BILL	.292	2.40
JAN	.0814	1.30
SEPOCT	-.0934	-2.09
$ ADV 4-11	-.139	-.899
$ ADV 0-1	-.0312	-.878

R-SQUARED = .9016
DURBIN-WATSON STATISTIC = 1.7337

Figure A.10.5.2
HSDG/CAT I-IIIA Accessions

REGRESSION 2

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

DEPENDENT VARIABLE: NON-HSDG/CATEGORY I-IIIA ACCESSIONS (logarithm)

FINAL VALUE OF RHO = .570884

RIGHT-HAND VARIABLE (logarithm)	ESTIMATED COEFFICIENT	T-STATISTIC
CONSTANT	-24.1	-1.75
EXAMS CAT I-IIIA	.796	2.31
LONG TERM OBJECTIVES	1.24	1.71
SHORT TERM OBJECTIVES	-.0518	-.457
UNEMPLOYMENT	-.320	-.614
RELATIVE PAY	-1.24	-1.11
RECRUITERS	2.60	1.62
GI BILL	.0552	.188
JAN	-.0116	-.101
SEPOCT	.0863	.813
$ ADV 4-11	-.946	-2.13
$ ADV 0-1	.0717	1.08

R-SQUARED = .82
DURBIN-WATSON STATISTIC = 1.6

Figure A.10.5.3
Non-ASDG/CAT I-IIIA Accessions

REGRESSION 3

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

DEPENDENT VARIABLE: HSDG/CATEGORY IIIB-IV (logarithm)

FINAL VALUE OF RHO = .261070

RIGHT-HAND VARIABLE	ESTIMATED COEFFICIENT	T-STATISTIC
CONSTANT	14.9	2.38
EXAMS CAT IIIB-IV	.481	2.61
LONG TERM OBJECTIVES	-1.03	-3.15
SHORT TERM OBJECTIVES	.234	4.20
UNEMPLOYMENT	.123	.479
RELATIVE PAY	1.16	2.64
RECRUITERS	-.111	-.150
GI BILL	.0138	.121
JAN	.0243	.349
SEPOCT	-.0882	-1.80
$ ADV 0-5	-.0969	-.652

R-SQUARED = .71
DURBIN-WATSON STATISTIC = 1.9

Figure A.10.5.4.
HSDG/CAT IIIB-IV Accessions

Section A.10.6. How Can the Final Linkage Models Best be Specified?

The key observations regarding the linkage between exam levels and accession levels (diminishing returns of accessions to exams importance of objectives in the conversion rate determination, and adjustment for the GI Bill) led to the following considerations in developing linkage models for each of the market segments.

The key independent variables used to specify accession variation are exam levels, short- and long-term objectives, and an adjustment for the GI Bill termination.

- The estimated models were linear in the logarithms of the dependent variable, accessions, and in the independent variables, in order to specify the multiplicative models required.
- The estimated coefficients from the log-log models were interpreted as elasticities.
- There was strong indication of auto-correlation in the residual series when ordinary least squares were used, so the Cochrane-Orcutt[1] algorithm, which adjusts the estimates based on the assumption of a first order auto-correlation in the residuals, was used to estimate the equation parameters.

These considerations were made specifying a linkage model for each of the market segments being analyzed. Multiple regression was used to estimate the coefficients of the log-log model. The indication of auto-correlation in the data required that the Cochrane-Orcutt technique be used to estimate the parameters of the regression equation.

The estimated linkage models presented in Figures A.10.6.1 - A.10.6.3 specify that accession rates are determined by exam levels and objective levels for the two high school degree segments, and by exam levels only for the Non-degree/Category I-IIIA segment. In addition, for the HSDG/ Category I-IIIA segment, the GI Bill termination had to be considered.

The estimated exam elasticities, .86 for the HSDG/Category I-IIIA Group and .61 for each of the other two groups, indicate the fractional return in accessions for a percentage increase in exams: a 10% increase in exams results in accesssions for the most desirable group and in a 6% increase in accessions for each of the other two groups. This indicates that diminishing returns are less of an issue for the first segment than for the other two segments.

The estimated elasticities for long term objectives, .71 for the HSDG/Category I-IIIA segment and .97 for the High School degree/Category IIIB-IV segment, reflect the observed pattern of shifting priorities during times of increased pressure. During periods when pressure is up, the relative emphasis will shift to the easier to access non-degree and low mental score segment, even though

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[1]COCHRANE, D. and G.H. ORCUTT, "Application of Least Squares Regressions to Relationships Containing Autocorrelated Error Terms," Journal of the American Statistical Association #44 (1949), pp.32-61.

more potential candidates in the other segments are brought as far into the system as examination.

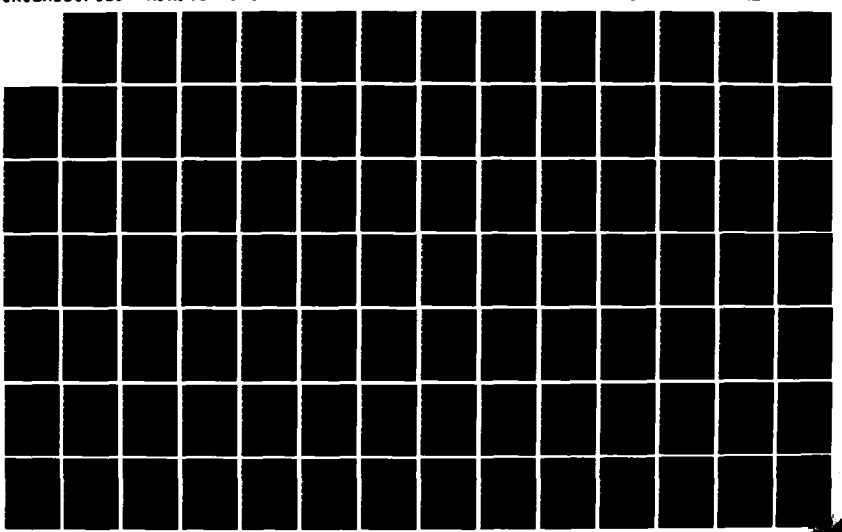
In general, we have seen that while increased advertising brings more people into the system (see exam model discussion), the rate at which the additional prospects are converted to accessions is dependent on other policy factors.

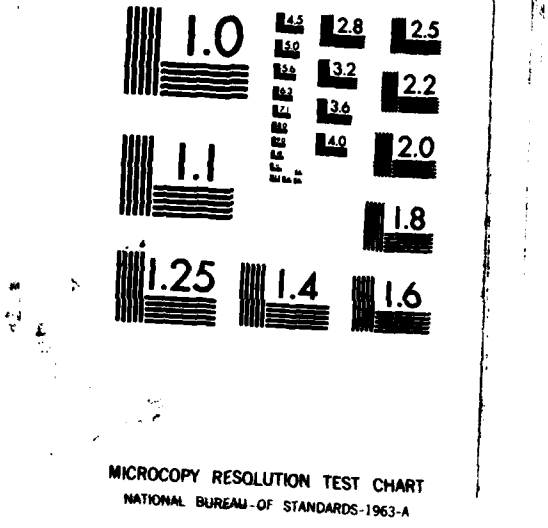
VARIABLE	COEFFICIENT	"t" STATISTIC
Constant	6.97	3.4
Log (CAT 1-3A Exams)	.86	8.7
Log (Long Term Objectives)	-.71	-2.9
Log (Short Term Objectives)	.078	1.97
GI Bill Dummy	.27	3.5
Auto Correlation Coefficient	.35	2.6
R^2	.88	

Figure A.10.6.1. HSDG/CAT I-IIIA Accessions - Logarithms

AD-A139 995 A STUDY OF THE EFFECTIVENESS OF THE ARMY'S NATIONAL ADVERTISING EXPENDITURES VOLUME 3 APPENDICES(U) AYER (N W) INC NEW YORK 31 AUG 81 USAREC-SR-81-1-VOL-3 2/3

UNCLASSIFIED MDA903-79-D-0001 F/G 5/1 NL





VARIABLE	COEFFICIENT	"t" STATISTIC
Constant	11.4	4.8
Log (Cat 3B-4 Exams)	.61	4.7
Log (Long Term Objectives)	-.97	2.9
Log (Short Term Objectives)	.17	3.3
Auto Correlation Coefficient	.47	3.7
R^2	.62	

Figure A.10.6.2. HSDG/CAT IIIB-IV Accessions - Logarithms

VARIABLE	COEFFICIENT	"t" STATISTIC
Constant	1.9	1.1
Log (Cat 1-3A Exams)	.61	3.2
Auto Correlation Coefficient	.81	9.5
R^2	.77	

Figure A.10.6.3. NHSDG/CAT I-IIIA Accessions - Logarithms

Section A.11. ARE THE MODELS ROBUST?

It was important to implement a systematic procedure for evaluating the validity and robustness of the models. This check provides comfort that the models as specified provide an accurate description of the recruiting process, and that the conclusions reached reflect a high degree of analytical precision.

The validity check consisted of two steps:

(1) a review of the goodness of fit of the models

(2) a review of the structural sensitivity of the fitted exam models to

- excluding variables

- re-estimating the model structure over a split-half time frame

The results show that the developed models track the actual accession data well, and are robust with respect to the tests used.

A more detailed discussion of the validity and robustness checks follows.

Section A.11.1. How Well Does the Two-stage Model Specification Track the Actual Data?

The monthly accession series, fitted using the model, were compared to actual accessions over the analysis time frame. The fitted accessions from the two-stage model for each target group were calculated as follows:

- Step 1 - Exams are calculated using advertising, other controllable and non-controllable environmental factors in the exam models.
- Step 2 - Accessions for each segment are determined using the calculated exams (appropriate mental category) in the linkage models.

The goodness of fit evaluated how well the model structure tracked the monthly recruiting performance data.

The fit was examined for:

- Each of two exam models
- Accession models for each of the three key market segments based on the two stage procedure
- Aggregates of the accession market segments

For the aggregate accession series, the component segments were added for both the actual and fitted series, and the correlation between the fitted and actual aggregates computed.

The squared correlations for the various fits (See Table A.11.1.1) range between 64% and 93%, which indicates a high degree of accuracy in explaining the series variations.

Graphs of the actual and fitted series are presented in figures A.11.1.1-A.11.1.7. These graphs clearly demonstrate that the process as described by the models closely track both long-term trends as well as month-to-month variation.

Table A.11.1.1. GOODNESS OF FIT

EXAM MODELS	R^2
I-IIIA EXAMS	.93
IIIB-IV EXAMS	.90
ACCESSION MODELS (2 STAGE)	
High School Degree/Category I-IIIA	.88
High School Degree/Category IIIB IV	.64
Non Degree/Category I-IIIA	.72
AGGREGATE ACCESSION MODELS (2 STAGES)	
All Market Segments Combined	.86
Total High School Degree	.86

TE	ACTUAL VALUE	FITTED VALUE
7604	.1021E+05	.1020E+05
7605	9425.	9626.
7606	.1123E+05	.1056E+05
7607	9672.	9831.
7608	9754.	9383.
7609	8566.	8611.
7610	8514.	9180.
7611	.1100E+05	.1075E+05
7612	9798.	.1003E+05
7701	8913.	9212.
7702	8627.	7935.
7703	8882.	8344.
7704	7127.	7090.
7705	6168.	6389.
7706	7321.	7688.
7707	6594.	7823.
7708	6969.	6689.
7709	5659.	5891.
7710	5809.	5951.
7711	7070.	6652.
7712	6495.	5962.
7801	6867.	6812.
7802	6377.	6143.
03	6428.	5856.
04	4844.	5080.
7805	4092.	4595.
7806	5618.	5204.
7807	5000.	5440.
7808	5793.	4875.
7809	4757.	4198.
7810	4798.	4483.
7811	5380.	5477.
7812	5003.	5435.
7901	6623.	6826.
7902	5584.	5956.
7903	5815.	5581.
7904	4770.	5552.
7905	4742.	4943.
7906	4963.	5825.
7907	5900.	6065.
7908	5753.	5174.
7909	4502.	4577.
7910	4955.	4616.
7911	5456.	5880.
7912	4969.	5881.
8001	7939.	7492.
8002	8073.	7153.
8003	6926.	6506.
8004	6586.	6631.
05	6677.	6733.
06	7716.	8429.
8007	9163.	8861.
8008	7605.	7253.
8009	6568.	6621.

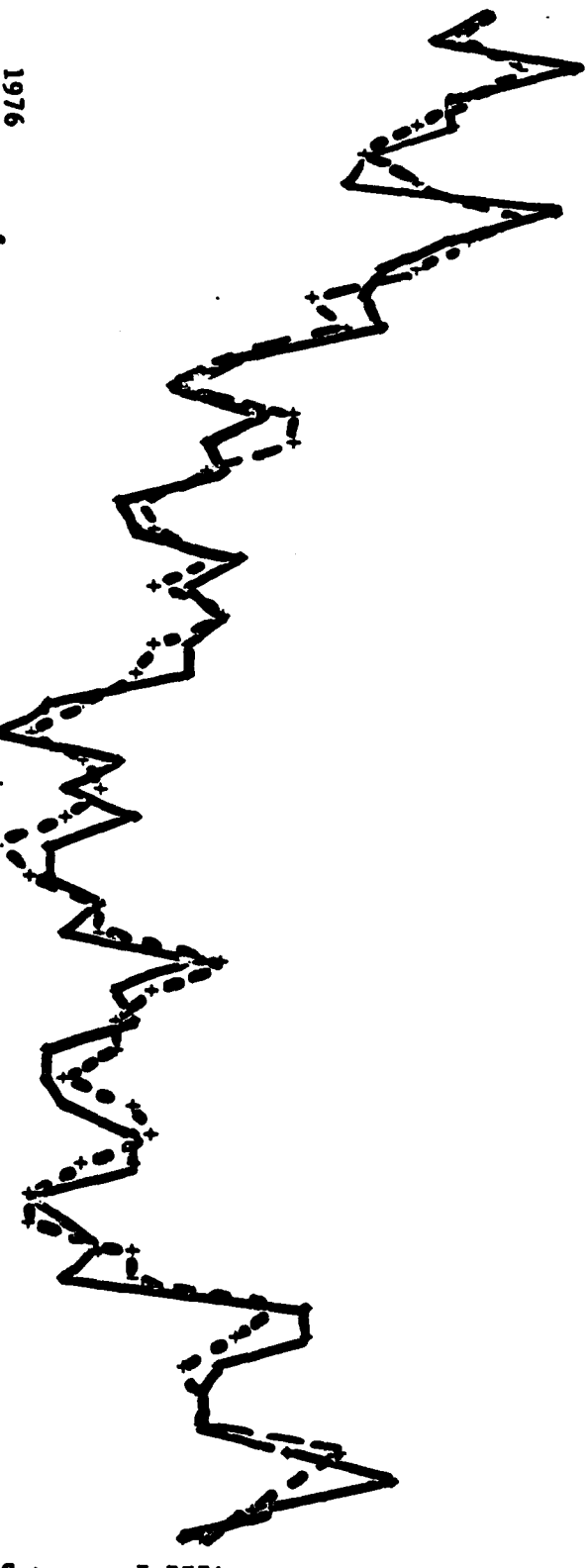


Figure A.11.1.1. Category I-IIIA

——— Exams

– – – Model Fit

DATE	ACTUAL VALUE	FITTED VALUE	PLOT *=ACTUAL +=FITTED
14	.1738E+05	.1826E+05	
05	.1659E+05	.1772E+05	
7606	.2094E+05	.2056E+05	
7607	.1730E+05	.1882E+05	1976
7608	.1930E+05	.1811E+05	
7609	.2003E+05	.1877E+05	
7610	.1905E+05	.1963E+05	
7611	.2225E+05	.2189E+05	
7612	.2200E+05	.2107E+05	
7701	.2169E+05	.2087E+05	
7702	.1730E+05	.1800E+05	
7703	.1794E+05	.1709E+05	
7704	.1509E+05	.1505E+05	
7705	.1349E+05	.1331E+05	1977
7706	.1584E+05	.1605E+05	
7707	.1249E+05	.1502E+05	
7708	.1112E+05	.1202E+05	
7709	.1008E+05	.1074E+05	
7710	.1022E+05	.1082E+05	
7711	.1192E+05	.1133E+05	
7712	.1123E+05	9739.	
7801	.1257E+05	.1318E+05	
7802	.1104E+05	.1145E+05	
7803	.1014E+05	.1089E+05	
7804	7940.	9048.	
15	7537.	8599.	
16	9911.	.1089E+05	1978
07	8890.	.1095E+05	
7808	.1052E+05	9390.	
7809	9161.	9337.	
7810	9015.	8901.	
7811	.1032E+05	9395.	
7812	9706.	9191.	
7901	.1293E+05	.1304E+05	
7902	.1008E+05	.1001E+05	
7903	.1105E+05	9356.	
7904	9807.	9688.	
7905	.1014E+05	9944.	
7906	.1165E+05	.1289E+05	1979
7907	.1305E+05	.1308E+05	
7908	.1360E+05	.1135E+05	
7909	.1127E+05	.1059E+05	
7910	.1232E+05	.1008E+05	
7911	.1248E+05	.1128E+05	
7912	.1005E+05	.1128E+05	
8001	.1718E+05	.1727E+05	
8002	.1647E+05	.1435E+05	
8003	.1319E+05	.1469E+05	
8004	.1298E+05	.1458E+05	1980
8005	.1344E+05	.1452E+05	
8006	.1767E+05	.1784E+05	
07	.2054E+05	.1694E+05	
08	.1530E+05	.1401E+05	
09	.1181E+05	.1408E+05	

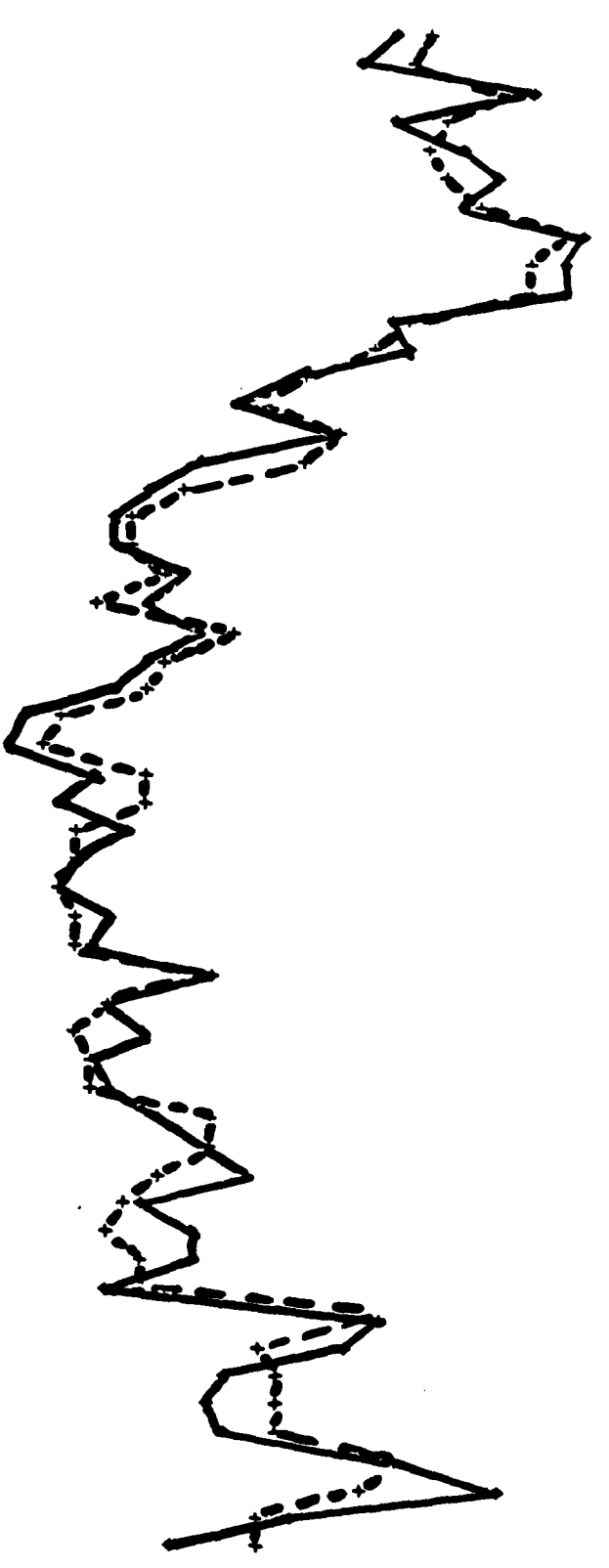


Figure A.11.1.2. Category I-IIIB

——— Exams

– – – Model Fit

DATE	ACTUAL VALUE	FITTED VALUE	
7604	3531.	3920.	
7605	3437.	3616.	
7606	4162.	4205.	
7607	3884.	3911.	1976
7608	3842.	3847.	
7609	3465.	3602.	
7610	3503.	3688.	
7611	4508.	4206.	
7612	4144.	3994.	
7701	2954.	2993.	
7702	2855.	2574.	
7703	3149.	2832.	
7704	2437.	2514.	
7705	2226.	2284.	
7706	2735.	2859.	
7707	2718.	2946.	1977
7708	3236.	2596.	
7709	2507.	2651.	
7710	2350.	2401.	
11	3162.	2748.	
12	2889.	2562.	
01	3148.	3045.	
7802	2770.	2697.	
7803	2782.	2493.	
7804	2132.	2195.	
7805	1721.	1989.	
7806	2459.	2272.	1978
7807	2276.	2531.	
7808	2481.	2154.	
7809	1969.	2081.	
7810	1985.	1898.	
7811	1978.	2238.	
7812	1919.	1964.	
7901	2808.	2587.	
7902	2317.	2334.	
7903	1629.	2116.	
7904	1804.	1997.	
7905	2564.	1918.	
7906	2568.	2629.	1979
7907	2311.	2436.	
7908	2321.	2065.	
7909	1742.	1989.	
7910	1832.	1737.	
7911	1992.	2262.	
7912	1760.	2037.	
01	2621.	2659.	
02	2603.	2645.	
003	2287.	2408.	1980

PLOT ◆=ACTUAL +=FITTED

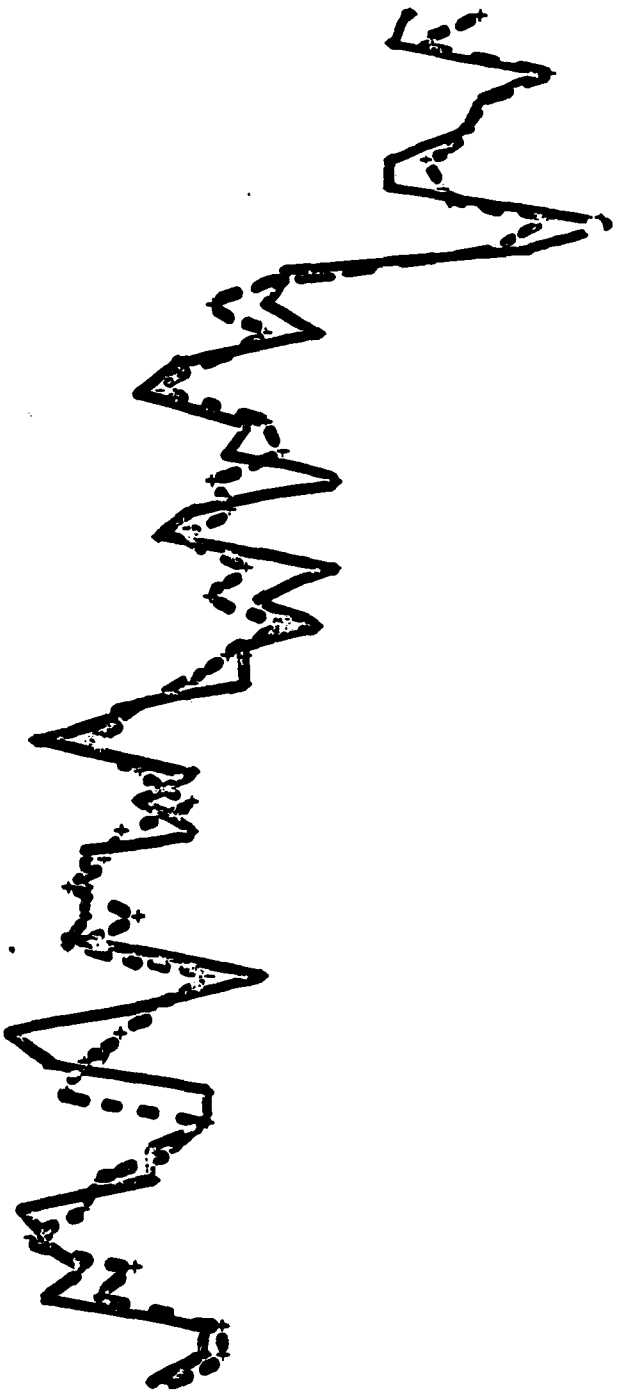


Figure A.11.1.3. HSDG/CAT I-IIIA

_____ Accessions

_ _ _ 2 Stage Model Fit

DATE	ACTUAL VALUE	FITTED VALUE	
7604	2683.	3050.	
7605	2646.	2836.	
7606	4287.	3770.	
7607	3421.	3473.	
7608	3729.	3626.	
7609	3789.	3817.	1976
7610	3672.	3496.	
7611	4589.	3947.	
7612	3292.	3773.	
7701	3632.	3709.	
7702	3550.	3351.	
7703	3857.	3586.	
7704	3276.	3319.	
7705	3080.	3174.	
7706	4000.	3914.	
7707	3793.	3567.	
7708	4097.	3461.	1977
7709	3496.	3548.	
7710	3120.	3131.	
11	4154.	3593.	
2	3855.	3415.	
01	4177.	4151.	
7802	3560.	3612.	
7803	3770.	3171.	
7804	2861.	2787.	
7805	2621.	2719.	
7806	3731.	3604.	
7807	3152.	3433.	1978
7808	3611.	3579.	
7809	3268.	3498.	
7810	3049.	2857.	
7811	3091.	3092.	
7812	3019.	2549.	
7901	3842.	3686.	
7902	3038.	2859.	
7903	2189.	2976.	
7904	2384.	2467.	
7905	3567.	2914.	
7906	3990.	3877.	1979
7907	3462.	3822.	
7908	3555.	3540.	
7909	2840.	3374.	
7910	2798.	2906.	
7911	2801.	3064.	
7912	2141.	2392.	
01	3248.	3791.	
02	3021.	3526.	1980
03	2755.	2999.	

PLOT ◆=ACTUAL +=FITTED

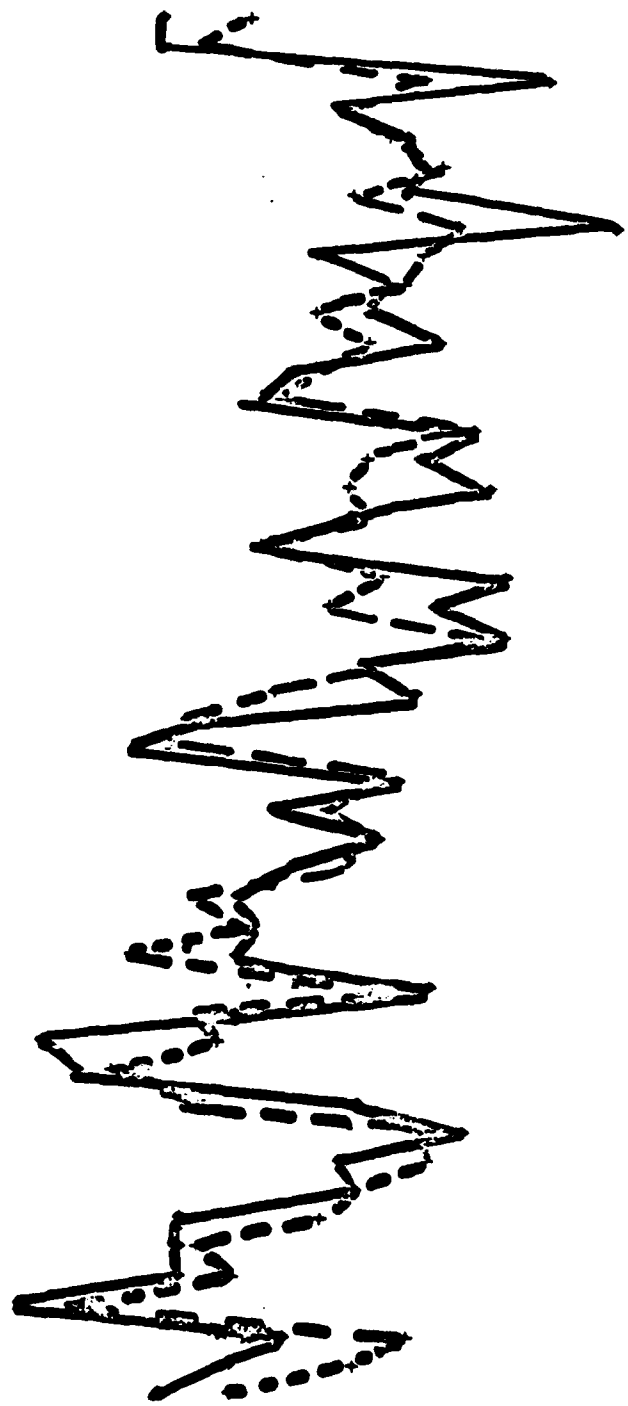


Figure A.11.1.4. HSDG/CAT IIIB-IV

_____ Accessions

_ _ _ Model Fit

DATE	ACTUAL VALUE	FITTED VALUE	
7604	2798.	1918.	
7605	2671.	2513.	
7606	2583.	2058.	
7607	2278.	2253.	1976
7608	2445.	1838.	
7609	2213.	2178.	
7610	2114.	1821.	
7611	2317.	2235.	
7612	2494.	1954.	
7701	2022.	2195.	
7702	1898.	1538.	
7703	1927.	2010.	
7704	1732.	1482.	
7705	1627.	1632.	
7706	1483.	1608.	1977
7707	871.0	1526.	
7708	491.0	939.6	
7709	464.0	809.0	
7710	732.0	877.9	
7711	1005.	1273.	
7712	1228.	1139.	
01	1525.	1591.	
02	1601.	1357.	
7803	1204.	1559.	
7804	940.0	1014.	
7805	1087.	1105.	
7806	1250.	1251.	
7807	1225.	1302.	1978
7808	1487.	1160.	
7809	1276.	1359.	
7810	1270.	1099.	
7811	1205.	1471.	
7812	1039.	1108.	
7901	1461.	1422.	
7902	1223.	1408.	
7903	891.0	1181.	
7904	1188.	1050.	
7905	1700.	1358.	
7906	1239.	1631.	
7907	1556.	1115.	1979
7908	1736.	1655.	
7909	1503.	1218.	
7910	1630.	1396.	
7911	1791.	1550.	
7912	1577.	1537.	
8001	2463.	1619.	
02	2431.	2166.	
03	1939.	1997.	1980

PLOT ◆=ACTUAL +=FITTED

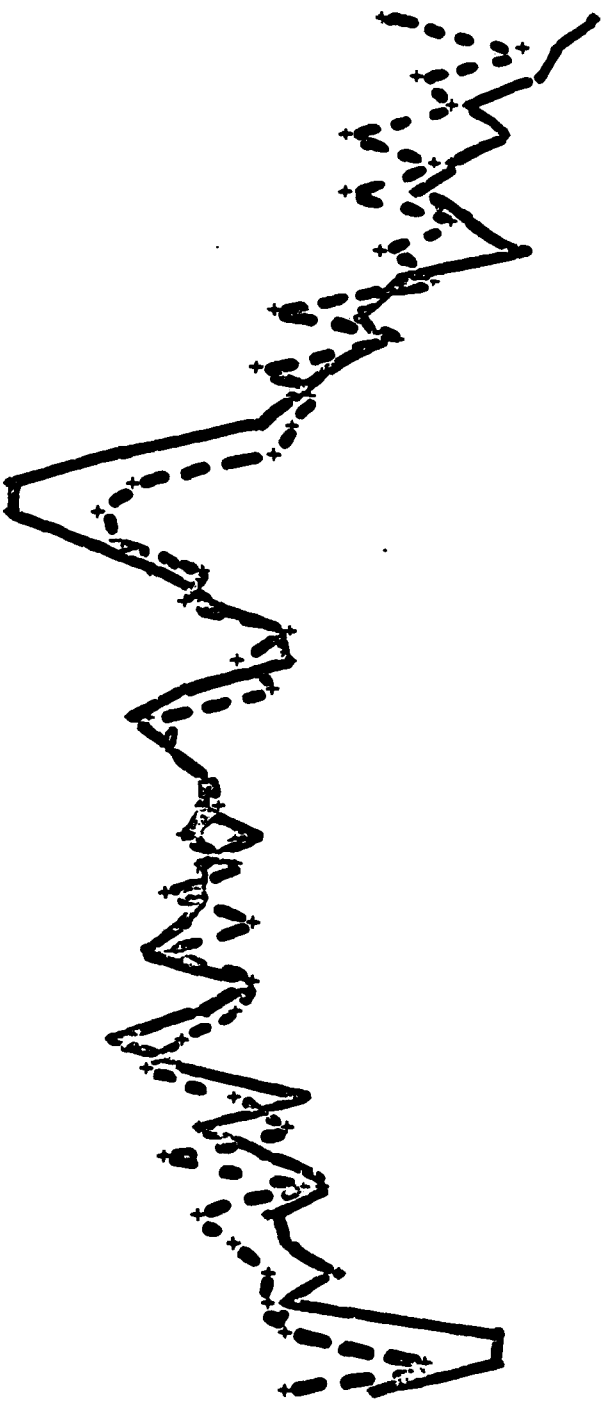


Figure A.11.1.5. NON-HSDG/CAT I-IIIA

_____ Accessions

_ _ _ Model Fit

DATE	ACTUAL VALUE	FITTED VALUE
7604	6214.	6971.
7605	6083.	6453.
7606	8449.	7974.
7607	7305.	7384.
7608	7571.	7474.
7609	7254.	7419.
7610	7175.	7184.
7611	9097.	8153.
7612	7436.	7767.
7701	6586.	6702.
7702	6405.	5925.
7703	7006.	6418.
7704	5713.	5834.
7705	5306.	5458.
7706	6735.	6773.
7707	6511.	6513.
7708	7333.	6057.
7709	6003.	6199.
7710	5470.	5532.
7711	7316.	6341.
12	6744.	5977.
01	7325.	7196.
802	6330.	6309.
7803	6552.	5664.
7804	4993.	4983.
7805	4342.	4708.
7806	6190.	5876.
7807	5428.	5965.
7808	6092.	5733.
7809	5237.	5578.
7810	5034.	4755.
7811	5069.	5330.
7812	4938.	4513.
7901	6650.	6273.
7902	5355.	5193.
7903	3818.	5092.
7904	4188.	4474.
7905	6131.	4832.
7906	6558.	6505.
7907	5773.	6258.
7908	5876.	5605.
7909	4582.	5363.
7910	4630.	4644.
7911	4793.	5326.
7912	3901.	4428.
101	5869.	6450.
02	5624.	6171.
03	5042.	5407.

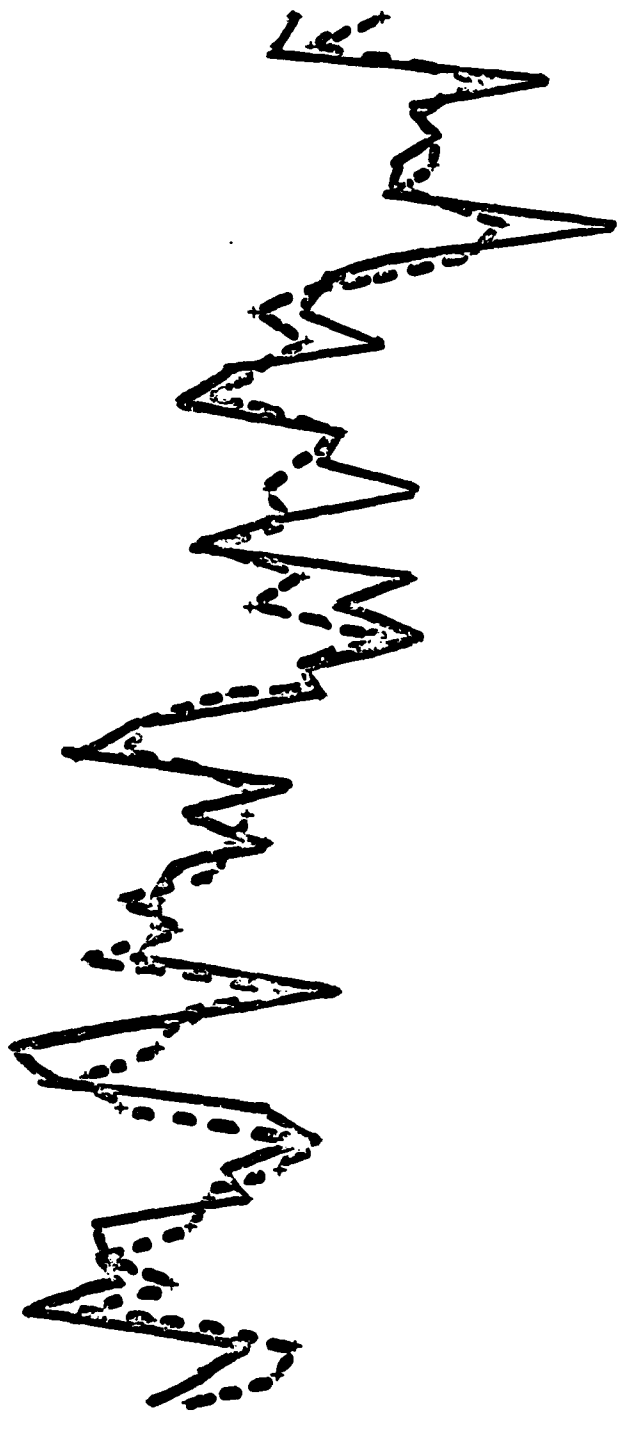


Figure A.11.1.6. Total High School
_____ Accessions
_ _ _ Model Fit

7604	9012.	8888.	
7605	8754.	8966.	
7606	.1103E+05	.1003E+05	
7607	9583.	9637.	
7608	.1002E+05	9312.	
7609	9467.	9597.	1976
7610	9289.	9005.	
7611	.1141E+05	.1039E+05	
7612	9930.	9721.	
7701	8608.	8897.	
7702	8303.	7463.	
7703	8933.	8428.	
7704	7445.	7316.	
7705	6933.	7090.	
7706	8218.	8381.	
7707	7382.	8039.	1977
7708	7824.	6997.	
7709	6467.	7008.	
7710	6202.	6410.	
7711	8321.	7614.	
7712	7972.	7115.	
7801	8850.	8786.	
02	7931.	7666.	
03	7756.	7223.	
804	5933.	5996.	
7805	5429.	5813.	
7806	7440.	7127.	1978
7807	6653.	7267.	
7808	7579.	6893.	
7809	6513.	6938.	
7810	6304.	5855.	
7811	6274.	6801.	
7812	5977.	5621.	
7901	8111.	7695.	
7902	6578.	6601.	
7903	4709.	6273.	
7904	5376.	5524.	
7905	7831.	6189.	
7906	7797.	8136.	1979
7907	7329.	7374.	
7908	7612.	7260.	
7909	6085.	6582.	
7910	6260.	6040.	
7911	6584.	6876.	
7912	5478.	5966.	
8001	8332.	8070.	
8002	8055.	8337.	
803	6981.	7005.	1980

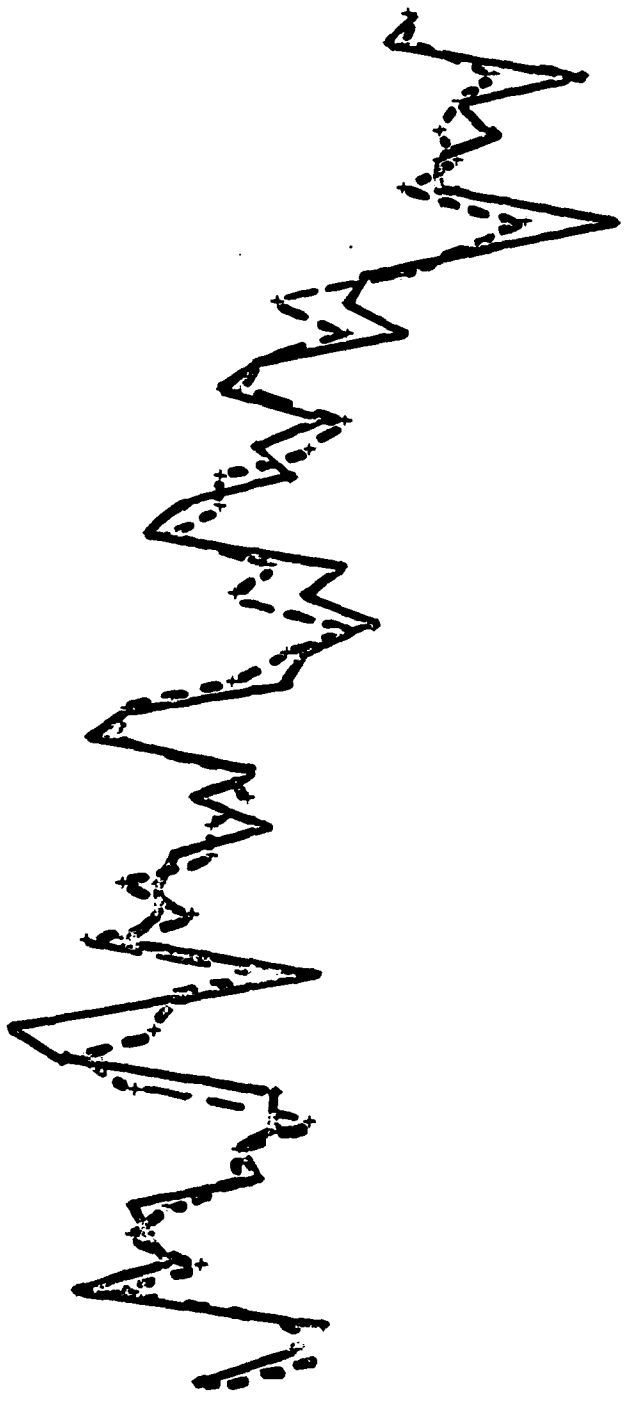


Figure A.11.1.7. High School & NON/HSDG/CAT I-IIIA

____ Accessions

_ _ _ Model Fit

Section A.11.2. Are the Exam Models Consistent over Different Time Spans?

The time frame was split into halves, and the coefficients in each of the two exam model structures were re-estimated over each of the two time spans. The purpose of this exercise was to provide verification that the basic model structure provides a description of the process that is consistent across different time spans.

Each of the resulting split time frames had 27 observations. These samples were clearly too small to attach any degree of statistical significance to the results; however, in a directional sense, the results provide clear evidence of the stability in the model structure.

The resulting analysis shows a high degree of structural robustness. With the exception of the production recruiter variable, each of the estimated variable coefficients kept the same sign in both samples. There was variation in the magnitude of the coefficients, most notably in the relative pay variable, but this would be expected given the small sample sizes. Overall, the basic structure of the estimated system showed little sensitivity to the change in time frame.

The re-estimated coefficients are presented in Table A.11.2.1 and A.11.2.2.

Table A.11.2.1. Category I-IIIA exam model coefficients estimated over two time frames.

	ESTIMATED MODEL COEFFICIENTS		
	TOTAL TIME FRAME		
	7604-8009	7604-7806	7807-8009
GI Bill	2948	2057	---
Unemployment	366	404	141
Objectives	.070	.809	.030
Relative Pay	6832	11620	1085
Recruiters	1.05	-.715	.228
JAN	1289	949	1542
SEPOCT	-693	-1103	-513
$ ADV (4-11)	.10	.055	.301
$ ADV (0-1)	.485	.551	.599
R^2	90	97	78

Table A.11.2.2. Category IIIB-IV exam model coefficients estimated over two time frames.

	ESTIMATED MODEL COEFFICIENTS		
	TOTAL TIME FRAME		
	7604-8009	7604-7806	7807-8009
GI Bill	5713	5043	---
Unemployment	543	332	729
Objectives	.247	.223	.208
Relative Pay	13846	30421	17832
Recruiters	3.76	-.165	4.29
JAN	3435	4280	3250
SEPTOCT	-781	-1271	-878
$ ADV(O-S)	.465	.647	.235
R^2	90	97	78

Section A.11.3. Are the Estimated Advertising Coefficients Sensitive to the Other Variables Included in the Model?

When evaluating the kind of multivariable structure specified in the exam models, it is important to determine whether the structural implications of each of the independent variables (the coefficient sign and the order of magnitude of coefficient size) had been strongly biased by the inclusion of one of the other variables in the model specification.

One way to evaluate the kind of structural sensitivity is to drop each of the variables from the model specification one at a time and to re-estimate the coefficients of the remaining variables under the reduced model specification. Particular attention was paid to the impact of the re-estimation on the advertising variables.

This re-estimation procedure was carried out for both of the exam models with the following results:

- the advertising variables in both exam model specifications maintain consistent signs and size with the removal of each of the other variables,
- the other variables are all consistent with respect to sign in the face of variable removal,

  the size of the coefficients is less stable for some of the variables, and
- the overall system structure is highly stable for both models.

The impact of variable exclusion on the advertising coefficients is summarized in Tables A.11.3.1 and A.11.3.2, where we see how the advertising variables change from the original model as the variables are dropped. Clearly, the unemployment variable has the biggest impact on the estimated advertising coefficients.

Tables A.11.3.3 and A.11.3.4 present the complete re-estimated model specification for each exam series, dropping the variables one at a time.

Table A.11.3.1. CATEGORY I-IIIA EXAM MODEL

EFFECT OF DROPPING VARIABLE
ON ADVERTISING COEFFICIENTS
(% Change in Advertising Coefficient from Original Model)

Variable Dropped	Long Term (4-11) Advertising Aggregate	Immediate Reponse Advertising	Total Advertising
GI Bill	-2%	+12%	+1.2%
Unemployment	137	-2	108
Objectives	55	-38	10
Relative Pay	74	-28	31
Recruiters	67	27	59
JAN	-27	2	-26
SEPOCT	-12	19	-7.4
Long Term $ADV (4-11)	—	-19	
Immediate Response $ADV (0-1)	-26	—	

Table A.11.3.2. CATEGORY IIIB-IV EXAM MODEL

EFFECT OF DROPPING VARIABLE
ON ADVERTISING AGGREGATE (0-5)
(% Change in Advertising Coefficient from Original Model)

GI Bill	-5%
Unemployment	+37
Objectives	-17
Relative Pay	0
Recruiters	29
JAN	11
SEPOCT	-2

Table A.11.3.3
EXCLUDING VARIABLES FROM
CATEGORY I-IIIA EXAM MODEL

VARIABLE DROPPED
(Coefficients re-estimated under reduced specification)

	CAT-I-IIIA EXAM MODEL	GI BILL	UNEM.	OBJ.	PAY	RECR.	JAN	SEPOCT	(4 - 11)	(0 - 1)
GI BILL	2948*		4134*	3538*	3496*	2914*	2623*	2855*	2606*	2975*
Unemployment	366*	599*		324*	351*	356*	419*	423*	413*	365*
Objectives	.070*	.179	.031		.039	.072*	.079*	.067*	.087*	.053*
Rel. Pay	6832*	15659*	5589	4126*		4996*	6540*	6413*	8909*	5743*
Recruiters	1.05*	.88	.80	1.13*	.475		.897	1.08*	1.64*	1.37*
JAN	1289*	727	1754*	1379*	1257*	1236*		1315*	1208*	1298*
SEPOCT	-695*	-534	-1194*	-673*	-650*	-705*	-721*		-660*	-770*
$ ADV (4-11)	.10*	.098	.237*	.155*	.174*	.167*	.073	.088		.074*
$ ADV (0-1)	.485*	.541	.480	.302	.344	.618*	.497*	.577*	.394*	
R^2	.93	.81	.85	.92	.91	.92	.90	.91	.92	.92

*Indicates "t" value exceeded 2.0

Table A.11.3.4
EXCLUDING VARIABLES FROM
CATEGORY IIIB-IV EXAM MODEL

VARIABLE DROPPED
(Coefficients re-estimated under reduced specification)

	CAT-IIIB-IV EXAMS MODEL	GI BILL	UNEM	OBJ.	PAY	RECR.	JAN	SEPOCT	(0 - 5)
GI Bill	5713*		6680*	7396*	6446*	4403*	5101*	5682*	5814*
Unemployment	543*	876*		549*	622*	562*	617*	603	828*
Objectives	.247*	.412*	.249*		.221*	.318*	.260x	.236*	.207*
Rel. Pay	13846*	23877*	16993*	10240		10332*	11240*	12660*	13672*
Recruiters	3.76*	.45	3.90*	5.59*	3.11*		2.76*	3.78*	5.45*
JAN	3435*	2419*	3793*	3659*	3119*	2781*		3490*	3855*
SEPOCT	-781	-663	-1455*	-346	-447	-811	-908		-657
ADV (0-5)	.465*	.486*	.635*	.383*	.463*	.602*	.517*	.459*	
R^2	90	78	87	85	88	87	86	90	85

*indicates "t" value exceeded 2.0

Section A.12. STEP BY STEP PROCEDURES FOR USING THE MODELS

A flow chart describing how to use these models in 3 steps is provided in Figure A.12.1. Each step is detailed below.

Step 1. Prepare monthly data on each independent variable.

Ten independent variables and a constant (all one's) are in the final exam models (see Figures A.8.6.1 andf A.9.5.1).

X_1 is the G.I. Bill indicator. The variable takes a value of 1 until December of 1976. From January of 1977 on, it takes a value of 0.

X_2 is unemployment (see Data Appendix D.1). Unemployment here is measured for 16-19 year olds and is not seasonally adjusted. The variable is the average of the current and the prior month's unemployment level. The source of this variable is the U.S. Department of Labor.

X_3 is recruiter objectives (C.1). Objectives here are for monthly non-prior-service male accessions. The source of this variable is the General Research Corporation.

X_4 is relative pay. Relative pay (G.3) is the ratio of E1 Pay (see C.2) and the civilian minimum wage (D.2).

X_5 is recruiter level (C.3). The recruiter level includes recruiters on production as well as station commanders. The source is USAREC.

X_6 is a January indicator. It takes the value 1 in January and 0 elsewhere.

X_7 is a September-October indicator and takes the value 1 in these two months and 0 elsewhere.

X_8 is the net deflated expenditure on radio and local advertising plus television spending one month earlier (F.11). The media expenditures are deflated to constant December 1978 dollars and adjusted to reflect net spending. Deflation for TV and radio requires a weighting of spot and prime (or network) deflators according to use. The source is N W Ayer Incorporated.

X_9 is the net deflated expenditure on all media summed from 4 to 11 months prior to the month in question.

X_{10} is the net deflated expenditure on all media summed from the month in question back through the previous 5 months.

Step 1

- PREPARE MONTHLY DATA ON EACH INDEPENDENT VARIABLE.

  See Data Appendix for sources and listing.

Step 2

- COMPUTE EXAMS USING EXAM MODEL

  See Figure A.12.2 and A.12.3. for a description of the model in equation form.

Step 3

- COMPUTE ACCESSIONS USING ACCESSION MODEL

  See Figure A.12.4 for a description of the model in equation form.

Figure A.12.1 Flow chart describing how to use the exam and accession models

The accession models include either of two additional variables (see Figures A.10.6.1 to A.10.6.3).

X_{11} is long-term recruiting objectives (see G.1). This variable is a 12-month centered moving average. See Figure A.12.4 for how our vendor, Computer Sciences Corporation, computes this average.

X_{12} is short-term recruiting objectives (see G.2). This is the ratio of X_3 to X_{11}.

Step 2. Compute exams from the exam models.

The equations to use are shown in Figures A.12.2.1 and A.12.2.2. The coefficients for each of the ten independent variables are listed below (see Figures A.8.6.1 and A.9.5.1).

Coefficient	CAT I-IIIA	CAT IIIB-IV
a_0	-13841	-35781
a_1	2948	5713
a_2	366	543
a_3	.070	.247
a_4	6832	13896
a_5	1.05	3.8
a_6	1289	3435
a_7	-695	-781
a_8	.485	
a_9	.10	
a_{10}		.465

$$Y_t = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7 + a_8X_8 + a_9X_9$$

where

Y_t is predicted CAT I-IIIA exams.

X_i is the i^{th} independent variable. It is described in Step 1 of Section A.12.

a_i is the i^{th} coeficient of variable i. It is listed above in Step 2 of section A.12.

Figure A.12.2. CAT I-IIIA Model in equation form.

$$Y_t = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7 + a_{10}X_{10}$$

where

Y_t is predicted CAT IIIB-IV exams.

X_i is the i^{th} independent variable. It is described in Step 1 of Section A.12.

a_i is the i^{th} coeficient of variable i. It is used in Step 2 of Section A.12.

Figure A.12.2.3. CAT IIIB-IV Model in equation form

Step 3. Compute accessions using accession Models.

The three equations to use are shown in Figures A.12.4 to A.12.6. The coefficients of each variable are listed below. Note that the coefficients are used as exponents.

Coefficient	HSDG/CAT 1-IIIA	HSDC/CAT IIIB-IV	NHSDG/CAT III B-IV
b_0	6.97	11.4	1.9
b_1	.86	.61	.61
b_2	-.71	-.97	
b_3	.078	.17	
b_4	.27		
b_5	.35	.47	.81

$$Z_t = e^{b0} Y_t^{b1} X_{11}^{b2} X_{12}^{b3} X_1^{b4} U_{t-1}^{b5}$$

where

Z_t is predicted HSDG/CAT I-IIIA accessions and e is 2.718.

Y_t is predicted CAT I-IIIA exams.

X_i is the i^{th} independent variable described in Step 1 of Section A.12.

U_{t-1} is actual HSDG CAT I-IIIA accessions in period $t-1$ divided by Z_{t-1}.

Figure A.12.4. HSDG/CAT I-IIIA Accession Model in equation form.

$$Z_t = e^{b0} Y_t^{b1} X_{11}^{b2} X_{12}^{b3} U_{t-1}^{b5}$$

where

Z_t is predicted HSDG/CATIIIB-IV accessions and e is 2.718.

Y_t is predicted CAT IIIB-IV exams.

X_i is the i^{th} independent variable described in Step 1 of Section A.12.

U_{t-1} is actual HSDG CAT IIIB-IV in period $t-1$ divided by Z_{t-1}.

Figure A.12.5. HSDG/CAT IIIB-IV Accession Model in equation form.

$$Z_t = e^{b0 Y_t U_{t-1}^{b5}}$$

where

Z_t is predicted NHSDG/CAT I-IIIA accessions
e is 2.718

Y_t is predicted CAT I-IIIA exams.

X_i is the i^{th} independent variable described in Step 1 of Section A.12.

U_{t-1} is actual NHSDG CAT I-IIIA accessions in period $t-1$ divided by Z_{t-1}.

Figure A.12.6. then NHSDG/CAT I-IIIA Accession Model in equation form.

. If the CENTER option is used and n = 2q is even, then Y_t is computed by the following formula:

$$Y_t = \frac{1}{w}\left(\frac{1}{2}X_{t+q} + X_{t+q-1} + \ldots + X_{t+1} + X_t + X_{t-1} + \ldots + X_{t-q+1} + \frac{1}{2}X_{t-q}\right)$$

with w as above.

Figure A.12.7. Computation of a centered moving average (n = 12 and w =1).

DATA APPENDIX A

PERFORMANCE VARIABLES

UNTRANSFORMED DATA SERIES

Data Appendix A. Performance Variables

Accessions by Date of Contract

A.1 High School Degree/Category I-IIIA
A.2 High School Degree/Category IIIB-IV
A.3 Non Degree/Category I-IIIA
A.4 Non-Degree/Category IIIB-IV

ASVAB Exams

A.5 Category I-IIIA
A.6 Category IIIB-IV

Data Appendix B. Media Variables

Advertising Spending

B.1 Television
B.2 Radio
B.3 Newspaper
B.4 Outdoor
B.5 Direct Mail
B.6 Local Advertising
B.7 Regular Magazines
B.8 Special Magazines

Media Deflators

B.9 Spot Television
B.10 Network Television
B.11 Spot Radio
B.12 Network Radio
B.13 Newspapers
B.14 Magazines
B.15 Outdoor

Data Appendix C. Policy Variables

C.1 Recruiter Accession Objectives
C.2 E1 Pay
C.3 Recruiter Numbers

Data Appendix D. Environmental Variables

D.1 Youth (16-19) Unemployment
D.2 Civilian Minimum Wage

ADJUSTED OR TRANSFORMED DATA SERIES

Data Appendix E. Performance Variables

Accessions by Date of Contract (the December 1976 GI Bill determined spike removed from the data)

E.1 High School Degree/Category I-IIIA
E.2 High School Degree/Category IIIB-IV
E.3 Non Degree/Category I-IIIA

ASVAB Exams (the December 1976 gI bill Determined spike removed from the data)

E.4 Category I-IIIA
E.5 Cateogry IIIB-IV

Data Appendix F. Media Variables

Advertising spending (deflated to constant Dec. 1978 dollars, and adjusted to reflect net spending levels throughout)

F.1 Television
F.2 Radio
F.3 Newspaper
F.4 Outdoor
F.5 Direct Mail
F.6 Local Advertising
F.7 Regular Magazines
F.8 Special Magazines

Aggregated Advertising Spending (aggregation is over deflated net dollars)

F.9 Total Media at Current period
F.10 Total Media Sum of Periods T-4 through T-11
F.11 Television (lagged 1 period) + Local Advertising + Newspaper
F.12 Total Media - Sum of Current Period Through Period T-5

Data Appendix G. Policy Variables

G.1 Recruiter Accession Objectives - Twelve Month Centered Moving Average
G.2 Recruiter Accession Objectives - Ratio of Monthly Objectives to Moving Average
G.3 Relative Pay - the Ratio of El Pay to the Civilian Minimum Wage

Series - Accession by date of contract

Source - Defense Manpower Data Center

Definition - Monthly Accessions into the Army counted during the month the original contract was signed.

Defining the data in this manner washes out the delays caused by the Delayed Entry Program.

Comments - Before use in the analysis each series was adjusted to remove the Dec. 1976 spike by replacing that month of data with the process mean.

Accessions by Date of Contract

A.1 High School Degree/Category I-IIIA
A.2 High School Degree/Category IIIB-IV
A.3 Non Degree/Category I-IIIA

The Data Appendices include a listing of each of the variables used in the analysis.

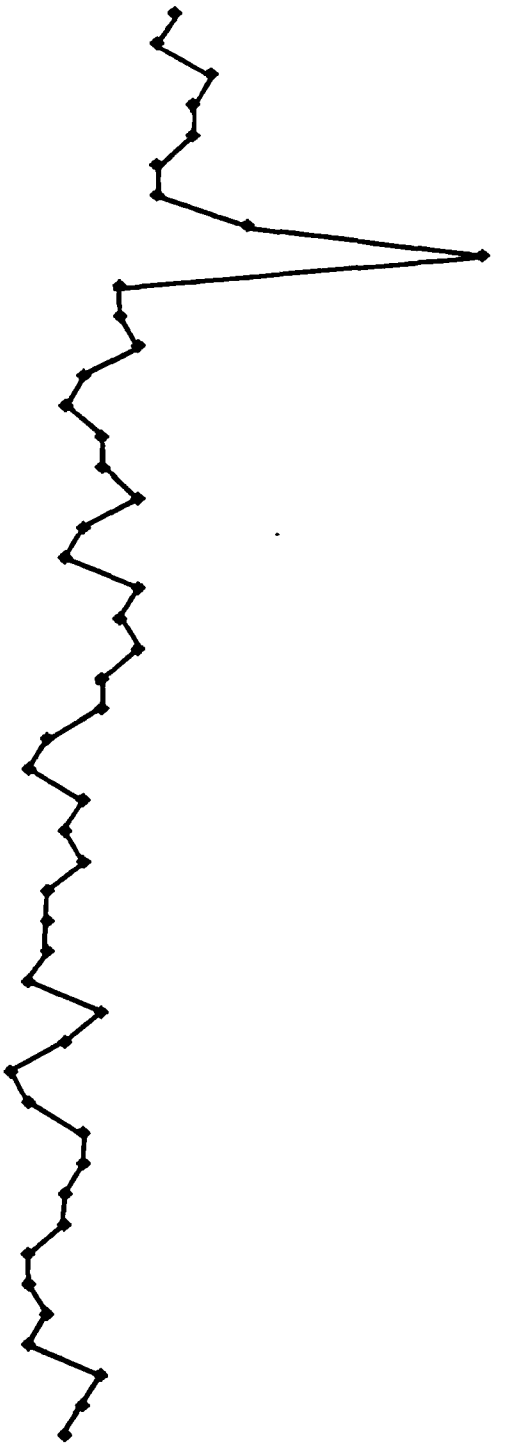
The data is listed in the untransformed state as received from the original source, and also listed as transformed where appropriate.

For each type of variable find a description, statement of source, and relevant comments.

For the data used directly in the model a plot is included. For the secondary data series--media deflators, a listing only is included.

HSDG/CATEGORY I-IIIA ACCESSIONS
(CONTRACT DATE)

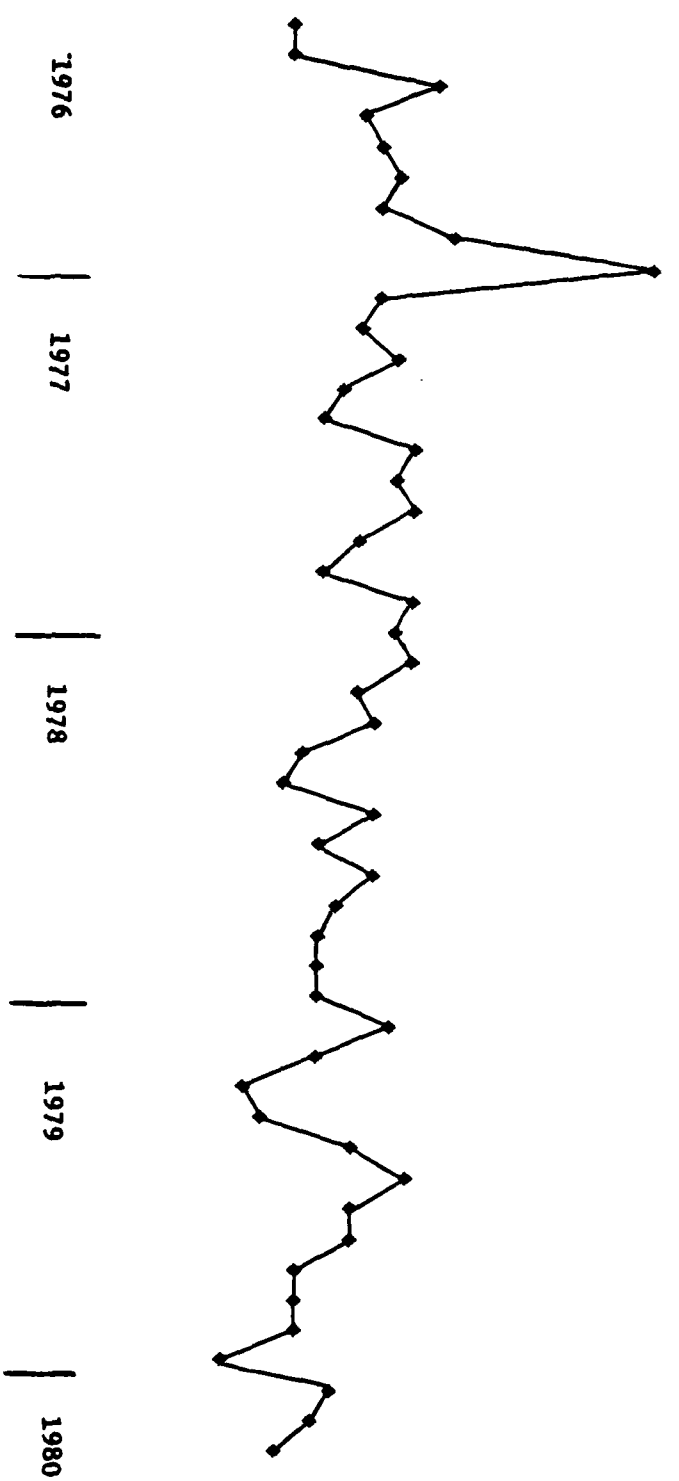
ATE	ACTUAL VALUE	FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
7604	3531.	0.	
7605	3437.	0.	
7606	4162.	0.	1976
7607	3884.	0.	
7608	3842.	0.	
7609	3465.	0.	
7610	3503.	0.	
7611	4508.	0.	
7612	7503.	0.	
7701	2954.	0.	
7702	2855.	0.	
7703	3149.	0.	1977
7704	2437.	0.	
7705	2226.	0.	
7706	2735.	0.	
7707	2718.	0.	
7708	3236.	0.	
7709	2507.	0.	
7710	2350.	0.	
7711	3162.	0.	
7712	2889.	0.	
7801	3148.	0.	
7802	2770.	0.	
03	2782.	0.	1978
04	2132.	0.	
7805	1721.	0.	
7806	2459.	0.	
7807	2276.	0.	
7808	2481.	0.	
7809	1969.	0.	
7810	1985.	0.	
7811	1978.	0.	
7812	1919.	0.	
7901	2808.	0.	
7902	2317.	0.	
7903	1629.	0.	1979
7904	1804.	0.	
7905	2564.	0.	
7906	2568.	0.	
7907	2311.	0.	
7908	2321.	0.	
7909	1742.	0.	
7910	1832.	0.	
7911	1992.	0.	
7912	1760.	0.	
8001	2621.	0.	
8002	2603.	0.	1980
8003	2287.	0.	



HSDG/CATEGORY IIIB-IV ACCESSIONS
(CONTRACT DATE)

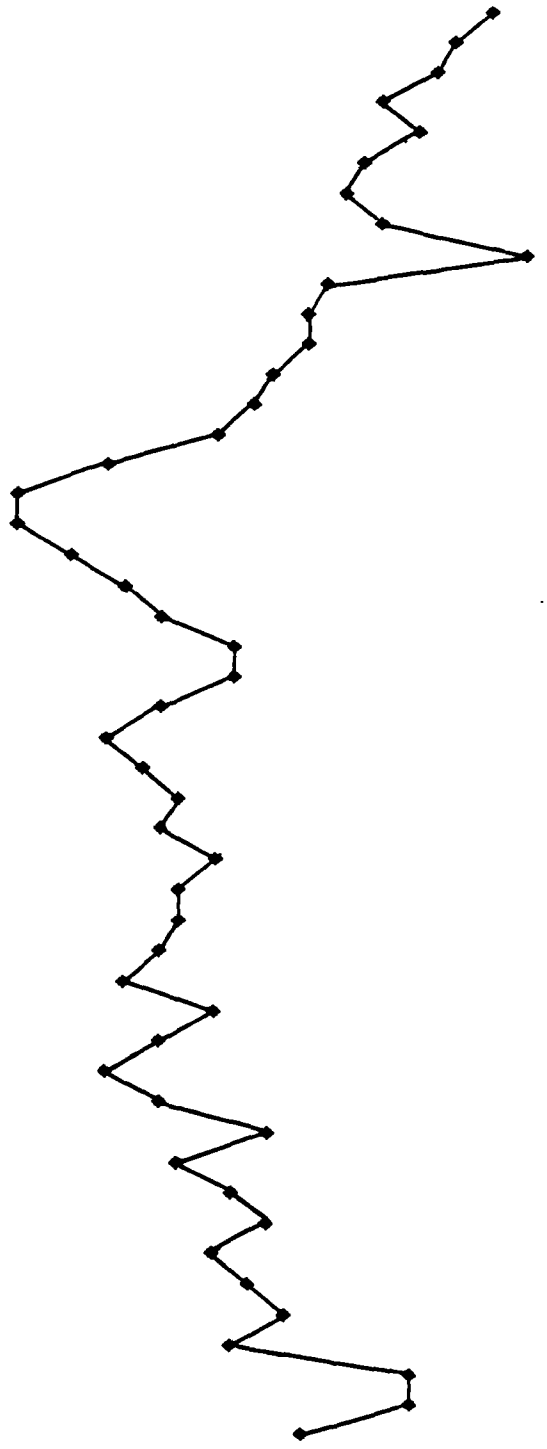
ITE	ACTUAL VALUE	FITTED VALUE
7604	2683.	0.
7605	2646.	0.
7606	4287.	0.
7607	3421.	0.
7608	3729.	0.
7609	3789.	0.
7610	3672.	0.
7611	4589.	0.
7612	6747.	0.
7701	3632.	0.
7702	3550.	0.
7703	3857.	0.
7704	3276.	0.
7705	3080.	0.
7706	4000.	0.
7707	3793.	0.
7708	4097.	0.
7709	3496.	0.
7710	3120.	0.
7711	4154.	0.
7712	3855.	0.
7801	4177.	0.
7802	3560.	0.
03	3770.	0.
04	2861.	0.
05	2621.	0.
7806	3731.	0.
7807	3152.	0.
7808	3611.	0.
7809	3268.	0.
7810	3049.	0.
7811	3091.	0.
7812	3019.	0.
7901	3842.	0.
7902	3038.	0.
7903	2189.	0.
7904	2384.	0.
7905	3567.	0.
7906	3990.	0.
7907	3462.	0.
7908	3555.	0.
7909	2840.	0.
7910	2798.	0.
7911	2801.	0.
7912	2141.	0.
8001	3248.	0.
8002	3021.	0.
8003	2755	0.

PLOT ◆=ACTUAL +=FITTED



NHSDG/CATEGORY I-IIIA ACCESSION
(CONTRACT DATE

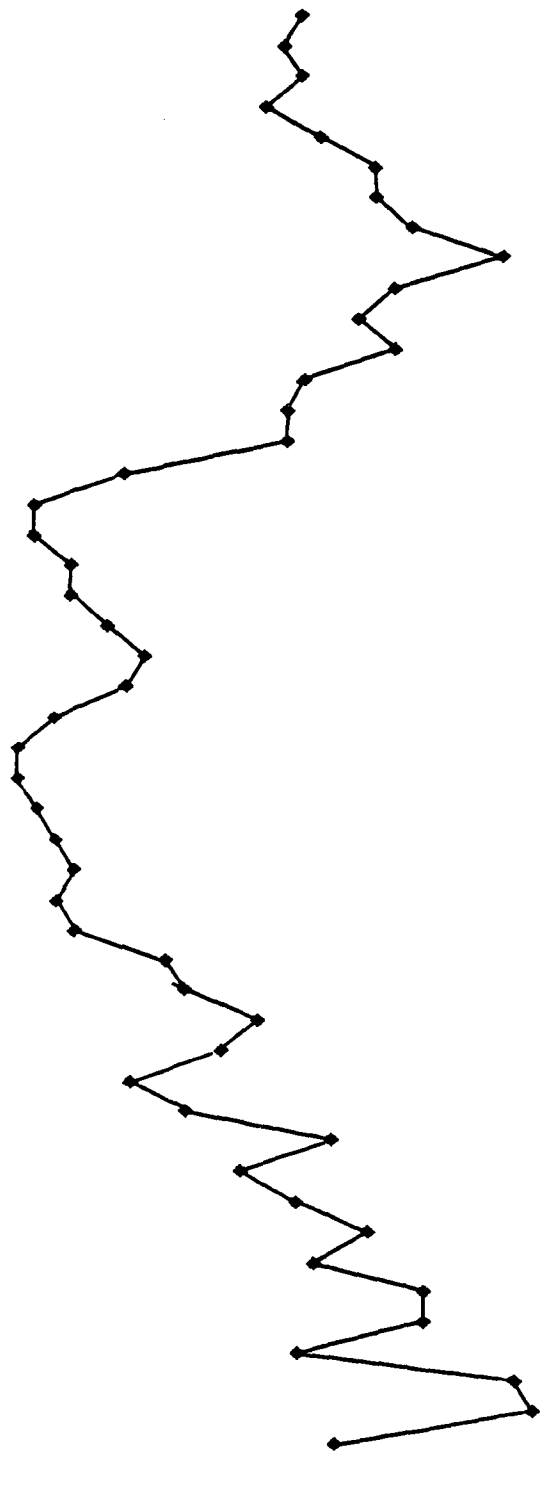
DATE	ACTUAL VALUE	FITTED VALUE .	PLOT ◆=ACTUAL +=FITTED
7604	2798.	0.	
7605	2671.	0.	
7606	2583.	0.	1976
7607	2278.	0.	
7608	2445.	0.	
7609	2213.	0.	
7610	2114.	0.	
7611	2317.	0.	
7612	3024.	0.	
7701	2022.	0.	
7702	1898.	0.	
7703	1927.	0.	1977
7704	1732.	0.	
7705	1627.	0.	
7706	1483.	0.	
7707	871.0	0.	
7708	491.0	0.	
7709	464.0	0.	
7710	732.0	0.	
7711	1005.	0.	
7712	1228.	0.	
7801	1525.	0.	
7802	1601.	0.	1978
7803	1204.	0.	
7804	940.0	0.	
7805	1087.	0.	
7806	1250.	0.	
7807	1225.	0.	
7808	1487.	0.	
7809	1276.	0.	
7810	1270.	0.	
7811	1205.	0.	
7812	1039.	0.	
7901	1461.	0.	
7902	1223.	0.	
7903	891.0	0.	1979
7904	1188.	0.	
7905	1700.	0.	
7906	1239.	0.	
7907	1556.	0.	
7908	1736.	0.	
7909	1503.	0.	
7910	1630.	0.	
7911	1791.	0.	
7912	1577.	0.	
8001	2463.	0.	
8002	2431.	0.	
8003	1939.	0.	1980



NHSDG/CATEGORY IIIB-IV ACCESSIONS
(CONTRACT DATE)

TE	ACTUAL VALUE	FITTED VALUE
7604	3673.	0.
7605	3580.	0.
7606	3674.	0.
7607	3311.	0.
7608	3950.	0.
7609	4393.	0.
7610	4431.	0.
7611	4815.	0.
7612	5605.	0.
7701	4682.	0.
7702	4173.	0.
7703	4537.	0.
7704	3734.	0.
7705	3612.	0.
7706	3472.	0.
7707	1950.	0.
7708	995.0	0.
7709	1082.	0.
7710	1456.	0.
7711	1388.	0.
7712	1685.	0.
7801	2059.	0.
7802	1995.	0.
7803	1216.	0.
7804	855.0	0.
7805	961.0	0.
7806	1063.	0.
7807	1242.	0.
7808	1437.	0.
7809	1290.	0.
7810	1388.	0.
7811	2324.	0.
7812	2393.	0.
7901	3164.	0.
7902	2783.	0.
7903	1966.	0.
7904	2513.	0.
7905	3850.	0.
7906	3101.	0.
7907	3623.	0.
7908	4172.	0.
7909	3795.	0.
7910	4734.	0.
7911	4830.	0.
7912	3619.	0.
8001	5725.	0.
8002	5848.	0.
8003	3948.	0.

PLOT *=ACTUAL +=FITTED



Series - ASVAB 6-7 Exams

Source - Defense Manpower Data Center

Definition - The number of ASVAB 6-7 exams completed throughout all Armed Forces Entry Examination stations administered under U.S. Army auspices.

Comments - The series was sorted by mental category score.

Before using in the analysis the december 1976 spike was removed and replaced by the process mean.

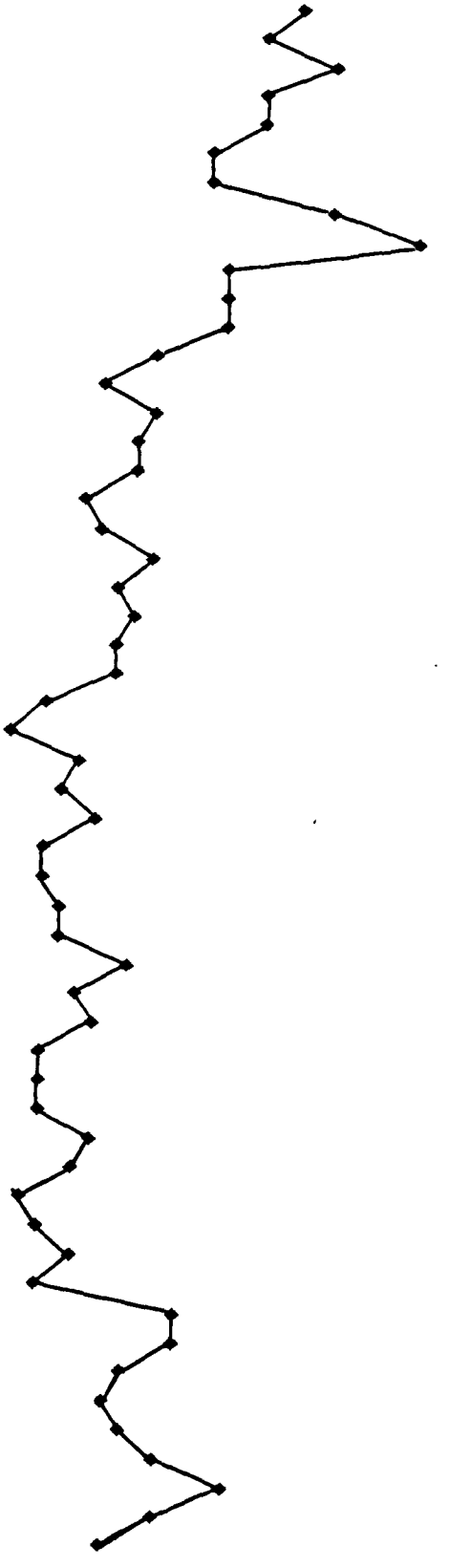
ASVAB Exams

A.5 Category I-IIIA
A.6 Category IIIB-IV

CATEGORY I-IIIA ASVAB EXAMS

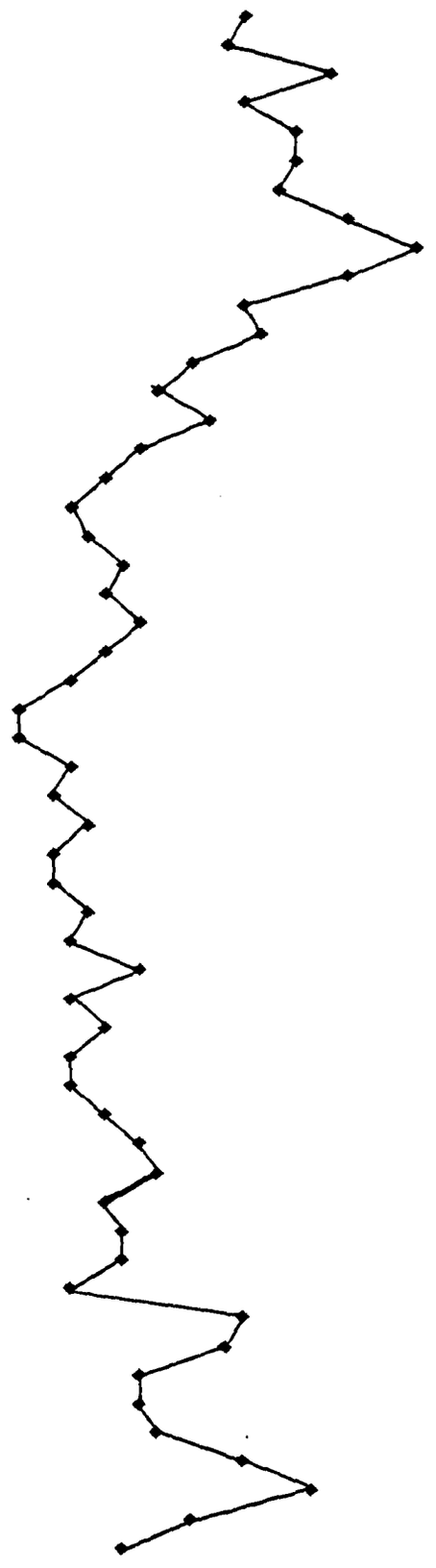
	ACTUAL VALUE	FITTED VALUE	
7604	.1021E+05	0.	
7605	9425.	0.	
7606	.1123E+05	0.	1976
7607	9672.	0.	
7608	9754.	0.	
7609	8566.	0.	
7610	8514.	0.	
7611	.1100E+05	0.	
7612	.1318E+05	0.	
7701	8913.	0.	
7702	8627.	0.	
7703	8882.	0.	
7704	7127.	0.	
7705	6168.	0.	
7706	7321.	0.	1977
7707	6594.	0.	
7708	6969.	0.	
7709	5659.	0.	
7710	5809.	0.	
7711	7070.	0.	
7712	6495.	0.	
7801	6867.	0.	
7802	6377.	0.	
7803	6428.	0.	
04	4844.	0.	
05	4092.	0.	
06	5618.	0.	1978
7807	5000.	0.	
7808	5793.	0.	
7809	4757.	0.	
7810	4798.	0.	
7811	5380.	0.	
7812	5003.	0.	
7901	6623.	0.	
7902	5584.	0.	
7903	5815.	0.	
7904	4770.	0.	
7905	4742.	0.	
7906	4963.	0.	1979
7907	5900.	0.	
7908	5753.	0.	
7909	4502.	0.	
7910	4955.	0.	
7911	5456.	0.	
7912	4969.	0.	
8001	7939.	0.	
8002	8073.	0.	
8003	6826.	0.	
8004	6586.	0.	
05	6677.	0.	
06	7716.	0.	
07	8163.	0.	1980
8008	7605.	0.	
8009	6568.	0.	

PLOT ◆=ACTUAL +=FITTED



CATEGORY IIIB-IV ASVAB EXAMS

DATE	ACTUAL VALUE	FITTED VALUE	
4	.1738E+05	0.	
05	1659E+05	0.	
7606	.2094E+05	0.	1976
7607	.1730E+05	0.	
7608	.1930E+05	0.	
7609	.2003E+05	0.	
7610	.1905E+05	0.	
7611	.2225E+05	0.	
7612	.2497E+05	0.	
7701	.2169E+05	0.	
7702	.1730E+05	0.	
7703	.1794E+05	0.	
7704	.1509E+05	0.	
7705	.1349E+05	0.	
7706	.1584E+05	0.	1977
7707	.1249E+05	0.	
7708	.1112E+05	0.	
7709	.1008E+05	0.	
7710	.1022E+05	0.	
7711	.1192E+05	0.	
7712	.1123E+05	0.	
7801	.1257E+05	0.	
7802	.1104E+05	0.	
7803	.1014E+05	0.	
7804	7940.	0.	
05	7537.	0.	
06	9911.	0.	1978
07	8890.	0.	
7808	.1052E+05	0.	
7809	9161.	0.	
7810	9015.	0.	
7811	.1032E+05	0.	
7812	9706.	0.	
7901	.1293E+05	0.	
7902	.1008E+05	0.	
7903	.1105E+05	0.	
7904	9807.	0.	
7905	.1014E+05	0.	
7906	.1165E+05	0.	1979
7907	.1305E+05	0.	
7908	.1360E+05	0.	
7909	.1127E+05	0.	
7910	.1232E+05	0.	
7911	.1248E+05	0.	
7912	.1005E+05	0.	
8001	.1718E+05	0.	
8002	.1647E+05	0.	
8003	.1319E+05	0.	
8004	.1298E+05	0.	
8005	.1344E+05	0.	
06	.1767E+05	0.	1980
07	.2054E+05	0.	
08	.1530E+05	0.	
8009	.1181E+05	0.	



DATA APPENDIX B

MEDIA VARIABLES

Series - Net and Deflated Media Spending Variables

Transformation - All media series were deflated by the appropriate deflators. The data from April 1976 through September 1978 had been expressed as gross expenditures and needed to be divided by 1.15 to achieve net expenditures.

F.1 Television*
F.2 Radio**
F.3 Newspaper
F.4 Outdoor
F.5 Direct Mail
F.6 Local Advertising
F.7 Regular Magazines
F.8 Special Magazines

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* The TV deflator is a weighted average of the TV spot deflator B.9 and the TV prime deflator B.10. The weights are the proportions of Spot and prime TV to total TV expenditures. We estimated that Spot TV was 100% of total TV expenditures until October 1977; then only 8% until October 1978; and the 25% until October 1980.

** The radio deflator is a similarly weighted average of the radio spot deflator B.11 and the radio network deflator B.12. We estimated that Spot radio was 100% of radio expenditures until October 1976, then 86% until October 1977; and finally 50% until October 1980.

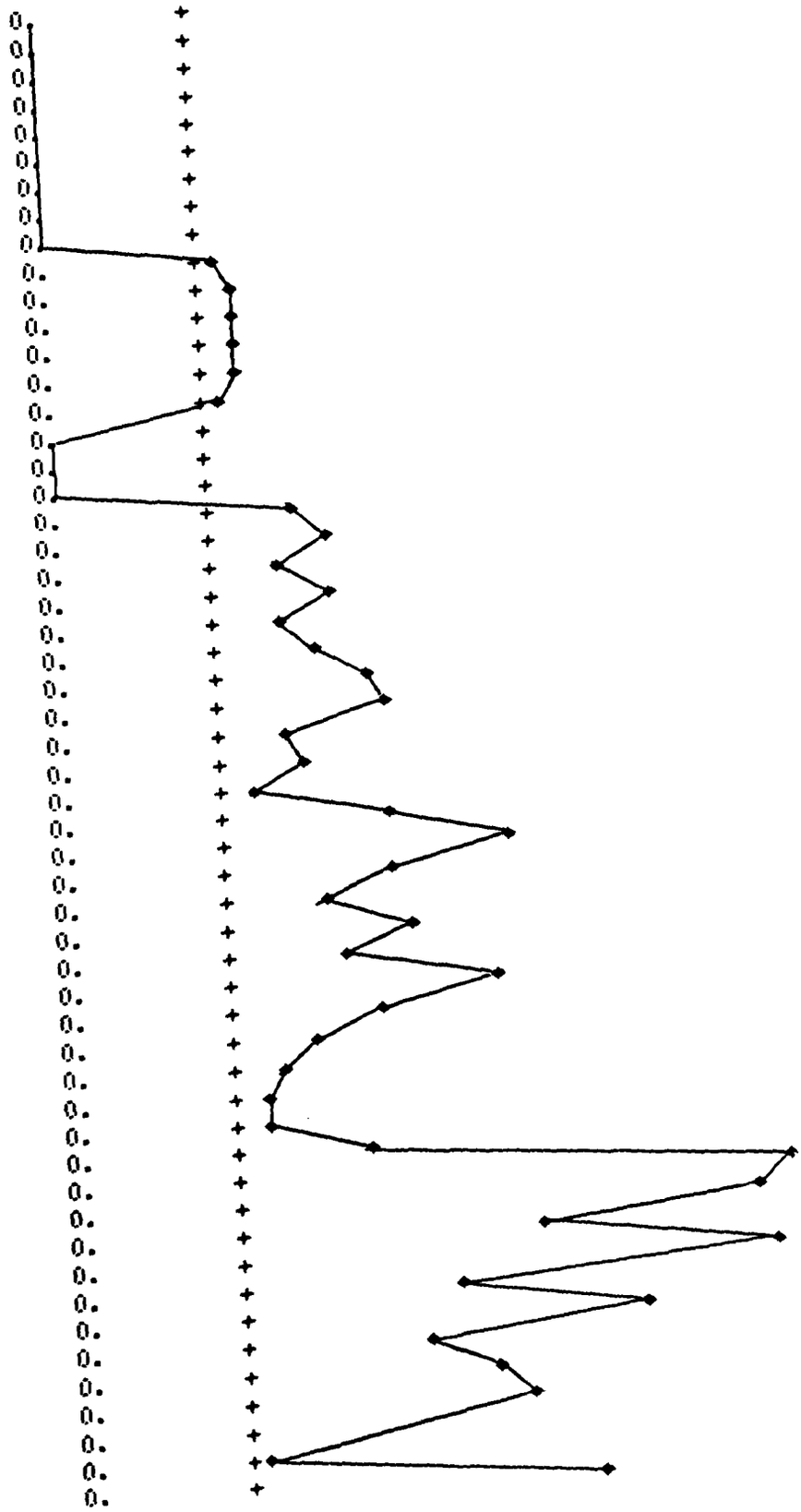
B.1

$ TELEVISION SPENDING

DATE	ACTUAL VALUE	FITTED VALUE
7604	0.	
7605	0.	
7606	0.	
7607	0.	
7608	0.	
7609	0.	
7610	0.	
7611	0.	
7612	0.	
7701	44.70	
7702	89.00	
7703	89.70	
7704	98.10	
7705	127.9	
7706	72.70	
7707	0.	
7708	0.	
7709	0.	
7710	305.4	
7711	383.7	
7712	240.0	
7801	425.1	
7802	234.9	
7803	341.6	
7804	505.7	
7805	571.6	
7806	232.0	
7807	286.2	
7808	102.7	
7809	604.9	
7810	978.5	
7811	588.7	
7812	325.9	
7901	633.0	
7902	385.7	
7903	906.5	
7904	548.2	
7905	283.9	
7906	179.0	
7907	91.00	
7908	95.20	
7909	474.5	
7910	1905.	
7911	1793.	
7912	1065.	
8001	1834.	
8002	751.6	
8003	1373.	
8004	634.1	
8005	841.5	
8006	984.2	
8007	17.80	
8008	47.10	
8009	1217.	

1976 1977 1978 1979 1980

PLOT ◆=ACTUAL +=FITTED

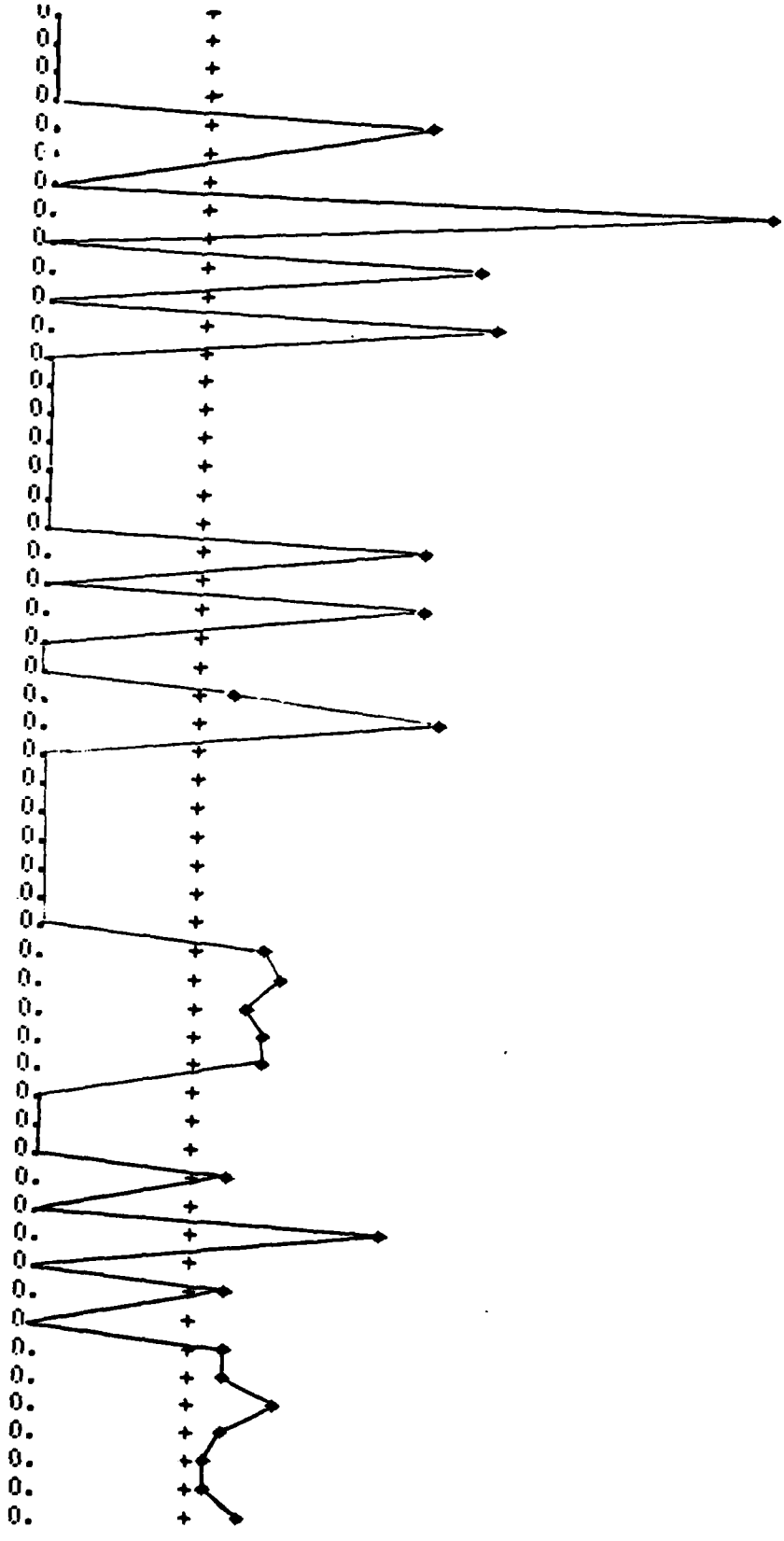


$ RADIO SPENDING

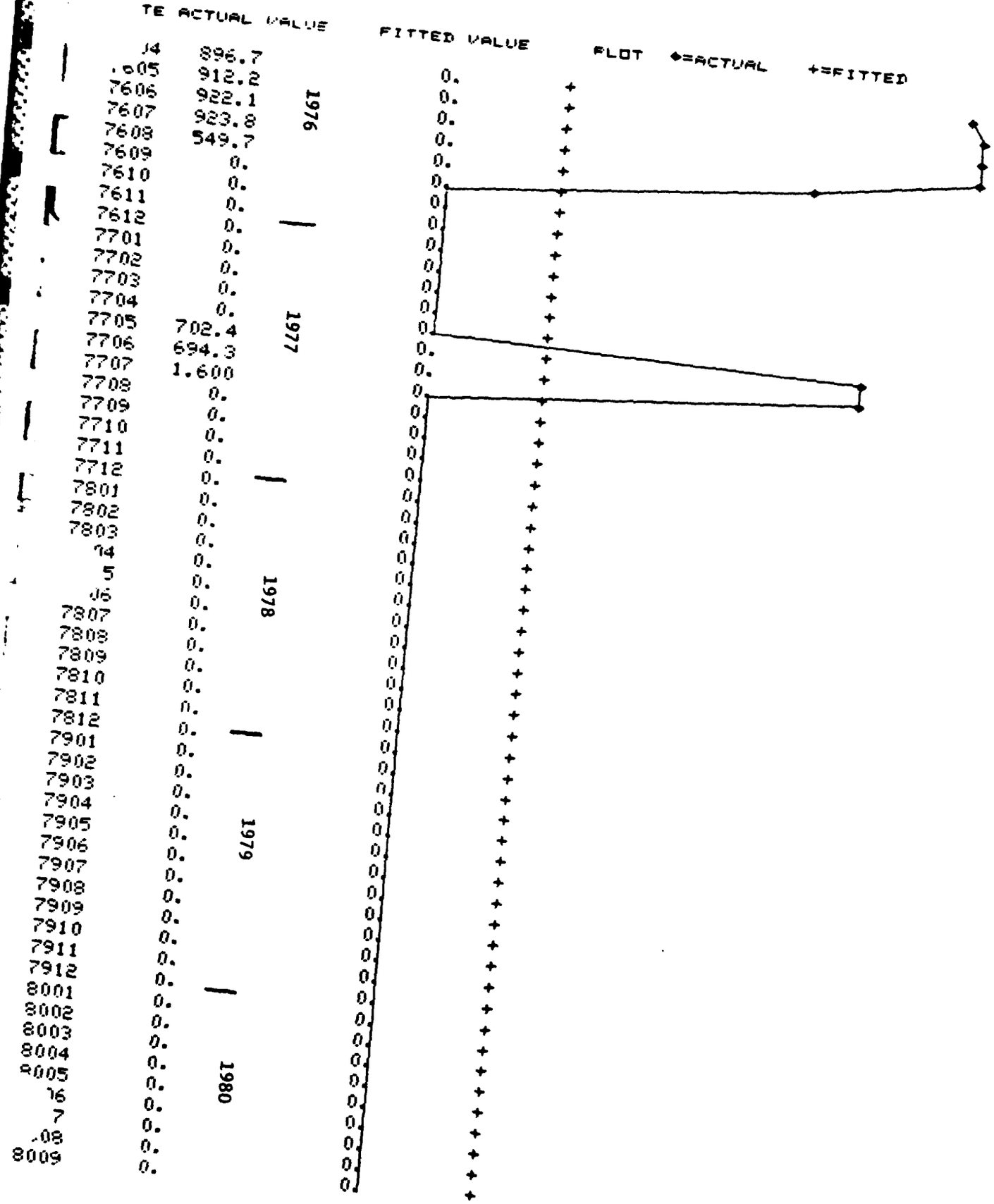
= E	ACTUAL VALUE		FITTED VALUE	PLOT ACTUAL
7604	0.		0.	+
7605	0.		0.	+
7606	0.	1976	0.	+
7607	0.		0.	+
7608	0.		0.	+
7609	0.		0.	+
7610	0.		0.	+
7611	536.4		0.	+
7612	703.6		0.	+
7701	884.5		0.	+
7702	413.0		0.	+
7703	315.1		0.	+
7704	254.4		0.	+
7705	292.0	1977	0.	+
7706	245.3		0.	+
7707	122.8		0.	+
7708	0.		0.	+
7709	0.		0.	+
7710	113.3		0.	+
7711	106.3		0.	+
7712	383.7		0.	+
7801	169.0		0.	+
7802	169.0		0.	+
03	169.0		0.	+
04	51.00		0.	+
05	51.00	1978	0.	+
7806	101.0		0.	+
7807	177.0		0.	+
7808	165.0		0.	+
7809	245.0		0.	+
7810	108.1		0.	+
7811	108.1		0.	+
7812	128.8		0.	+
7901	0.		0.	+
7902	0.		0.	+
7903	181.9		0.	+
7904	268.2		0.	+
7905	209.0	1979	0.	+
7906	146.7		0.	+
7907	120.9		0.	+
7908	79.70		0.	+
7909	439.6		0.	+
7910	247.1		0.	+
7911	97.50		0.	+
7912	24.40		0.	+
8001	282.4		0.	+
8002	157.2		0.	+
8003	338.7		0.	+
8004	225.2		0.	+
05	116.1	1980	0.	+
06	363.6		0.	+
07	149.8		0.	+
8008	472.8		0.	+
8009	637.1		0.	+

$ NEWSPAPER SPENDING

7604	0.	
7605	0.	
7606	0.	1976
7607	0.	
7608	467.3	
7609	0.	
7610	0.	
7611	1148.	
7612	0.	
7701	556.0	
7702	0.	
7703	582.2	
7704	0.	
7705	0.	1977
7706	0.	
7707	0.	
7708	0.	
7709	0.	
7710	0.	
7711	456.6	
7712	0.	
7801	447.0	
7802	0.	
7803	0.	
7804	55.60	
7805	474.5	1978
7806	0.	
7807	0.	
7808	0.	
7809	0.	
7810	0.	
7811	0.	
7812	0.	
7901	148.7	
7902	182.7	
7903	100.0	
7904	134.0	
7905	134.0	1979
7906	0.	
7907	0.	
7908	0.	
7909	56.70	
7910	0.	
7911	368.6	
7912	0.	
8001	67.90	
8002	0.	
8003	70.90	
8004	75.20	
8005	170.0	1980
8006	75.70	
8007	45.90	
8008	45.90	
8009	88.90	



$ OUTDOOR SPENDING



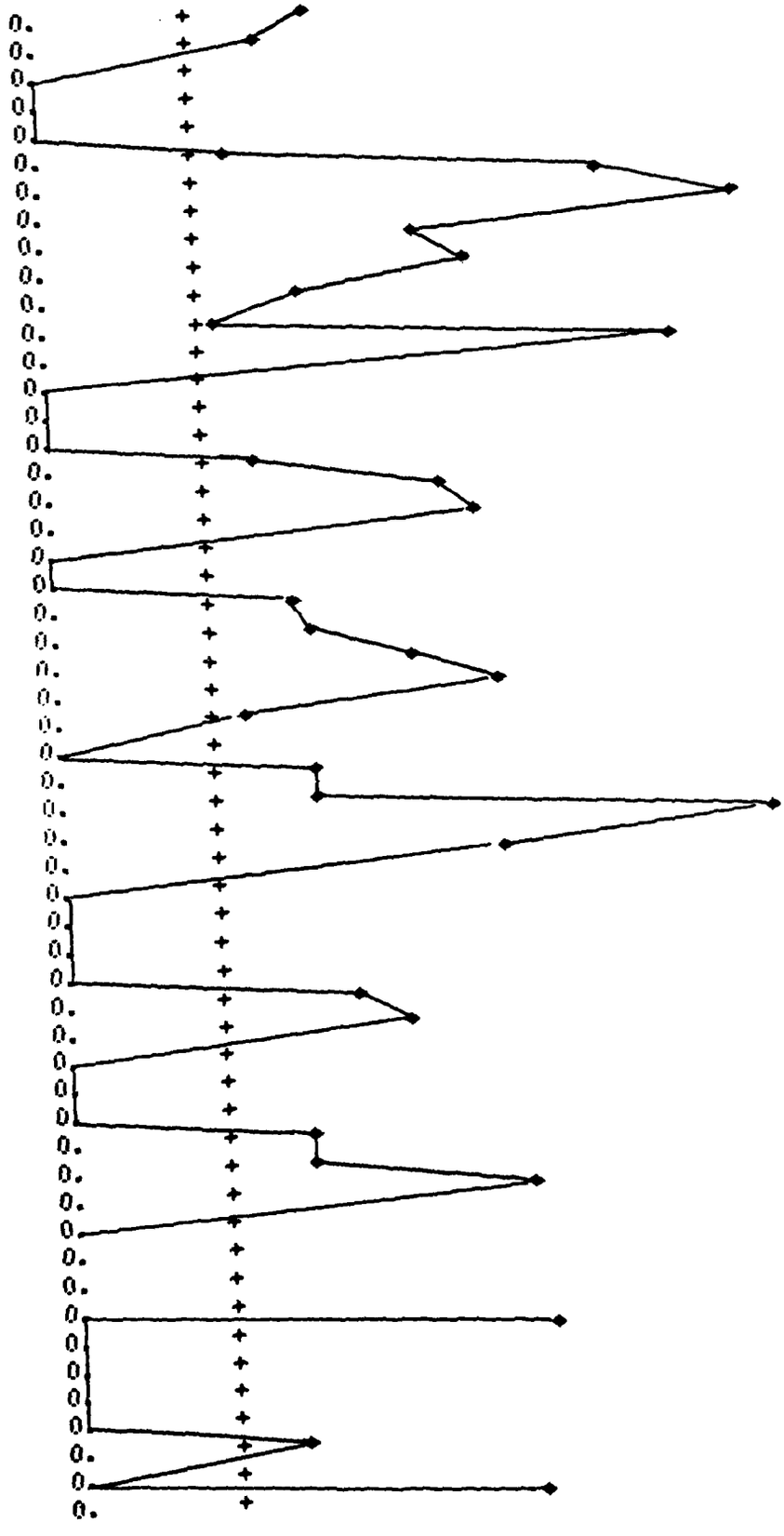
B.5

$ DIRECT MAIL

*E	ACTUAL VALUE	FITTED VALUE
,04	186.8	
7605	90.75	
7606	0.	
7607	0.	
7608	0.	
7609	49.50	
7610	610.5	
7611	808.5	
7612	330.0	
7701	396.0	
7702	165.0	
7703	33.00	
7704	726.0	
7705	0.	
7706	0.	
7707	0.	
7708	66.00	
7709	346.5	
7710	396.0	
7711	0.	
7712	0.	
7801	125.4	
7802	165.0	
?03	297.0	
14	426.7	
05	49.50	
7806	0.	
7807	165.0	
7808	165.0	
7809	841.5	
7810	445.5	
7811	0.	
7812	0.	
7901	0.	
7902	0.	
7903	197.2	
7904	291.4	
7905	0.	
7906	0.	
7907	0.	
7908	123.7	
7909	123.7	
7910	470.3	
7911	0.	
7912	0.	
8001	0.	
8002	0.	
8003	478.5	
8004	0.	
05	3.300	
16	0.	
07	99.00	
8008	0.	
8009	462.	

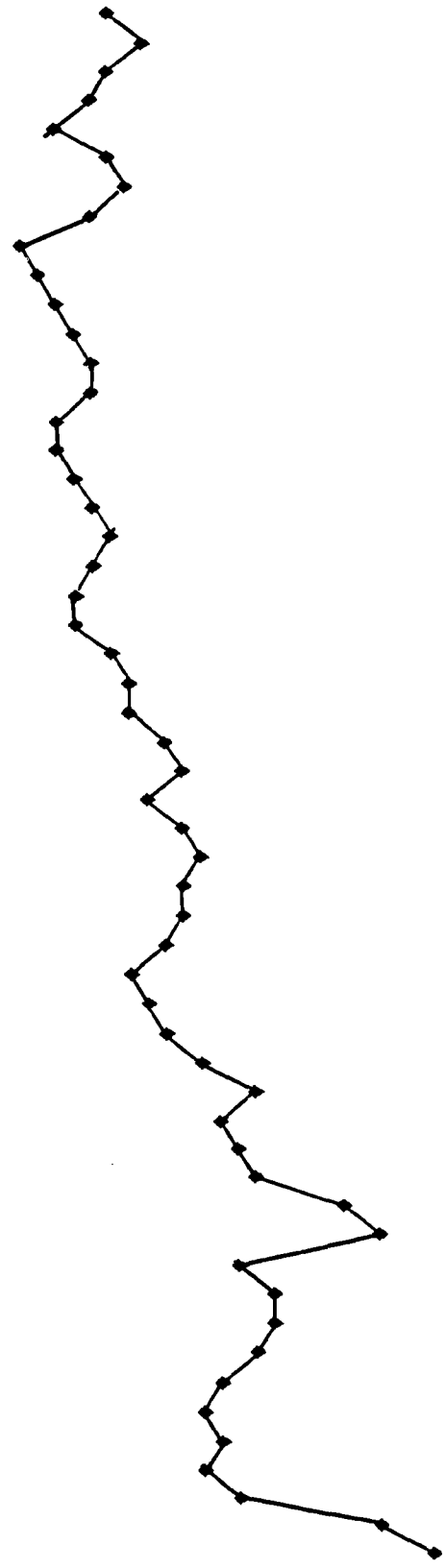
1976 1977 1978 1979 1980

PLOT ◆=ACTUAL +=FITTED



$ LOCAL ADVERTISING

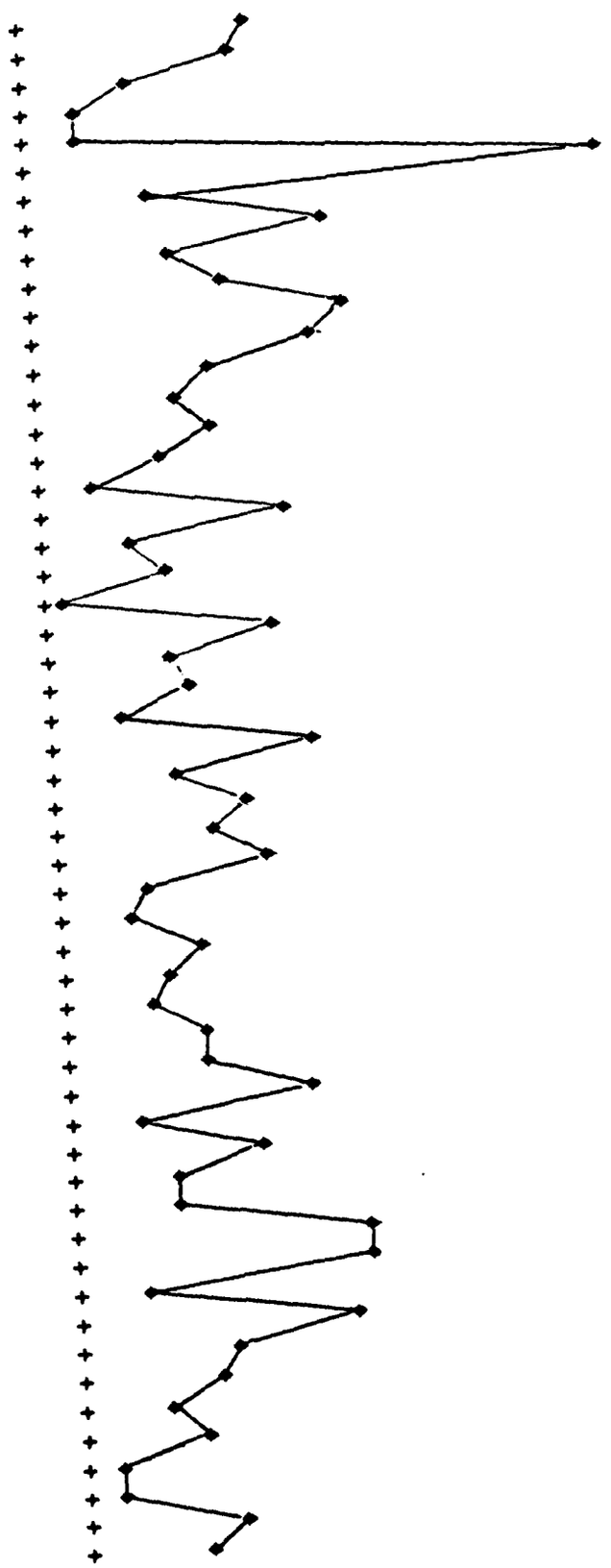
7604	292.0		0.	+
7605	325.6		0.	+
7606	290.0	1976	0.	+
7607	268.5		0.	+
7608	232.9		0.	+
7609	301.9		0.	+
7610	309.2		0.	+
7611	280.4		0.	+
7612	200.4		0.	+
7701	211.0		0.	+
7702	241.2		0.	+
7703	259.7		0.	+
7704	284.0		0.	+
7705	282.5	1977	0.	+
7706	242.3		0.	+
7707	231.3		0.	+
7708	255.2		0.	+
7709	266.4		0.	+
7710	287.3		0.	+
7711	283.2		0.	+
7712	253.1		0.	+
7801	265.3		0.	+
7802	288.3		0.	+
03	311.0		0.	+
4	319.0		0.	+
05	350.8		0.	+
7806	370.9	1978	0.	+
7807	341.4		0.	+
7808	370.9		0.	+
7809	402.5		0.	+
7810	373.4		0.	+
7811	377.2		0.	+
7812	347.6		0.	+
7901	310.4		0.	+
7902	336.1		0.	+
7903	359.1		0.	+
7904	389.6		0.	+
7905	454.6	1979	0.	+
7906	411.2		0.	+
7907	441.3		0.	+
7908	461.3		0.	+
7909	545.0		0.	+
7910	582.7		0.	+
7911	423.8		0.	+
7912	465.3		0.	+
8001	481.7		0.	+
8002	442.9		0.	+
8003	420.9		0.	+
8004	401.5		0.	+
05	404.6	1980	0.	+
06	387.5		0.	+
07	440.0		0.	+
8008	594.7		0.	+
8009	649.0		0.	+



$ REGULAR MAGAZINE SPENDING

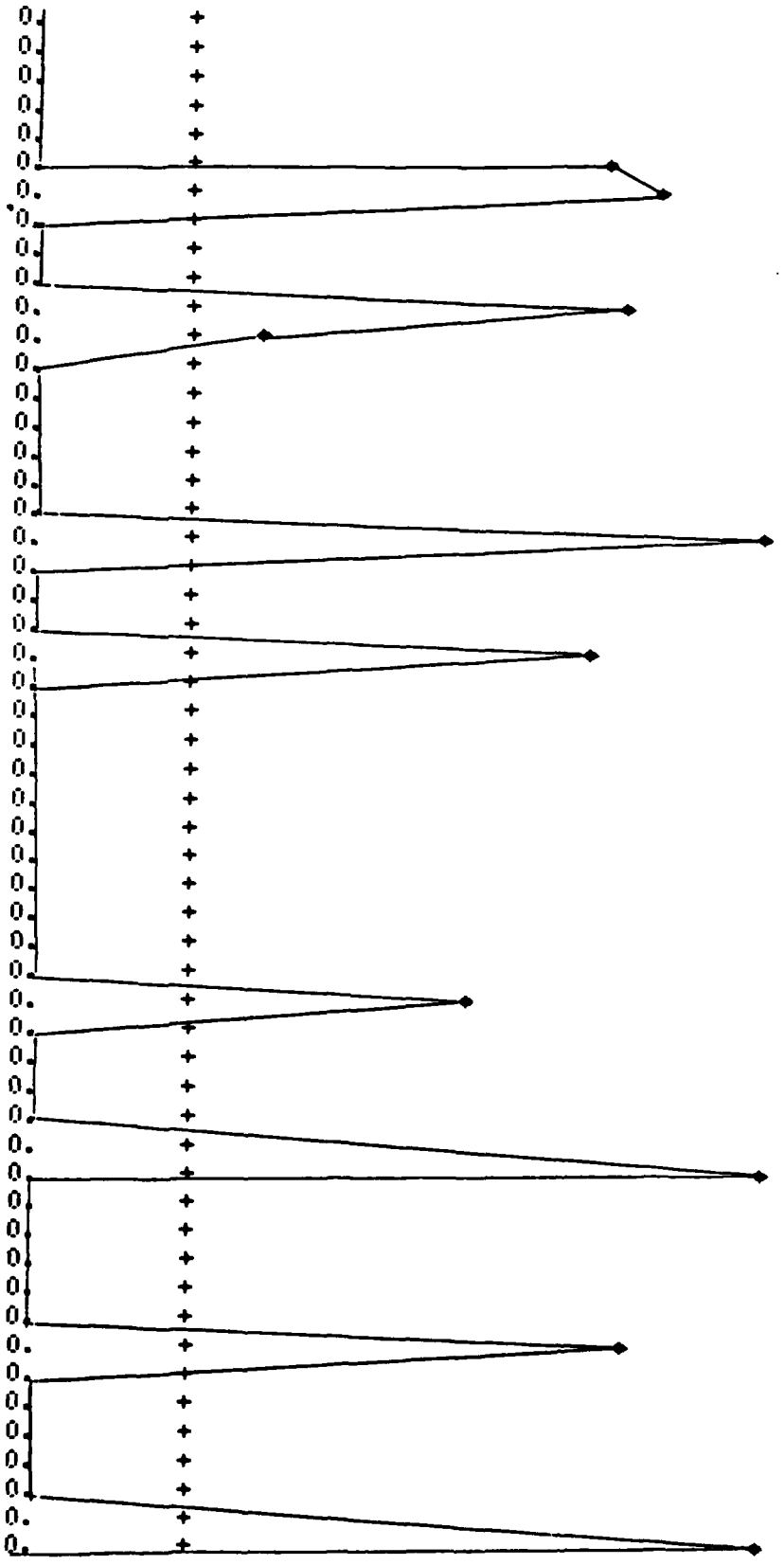
DATE	ACTUAL VALUE		FITTED VALUE
7604	572.9		0.
7605	520.4		0.
7606	262.4	1976	0.
7607	127.8		0.
7608	113.5		0.
7609	1442.		0.
7610	323.5		0.
7611	741.4		0.
7612	344.8		0.
7701	501.1		0.
7702	778.5		0.
7703	694.7		0.
7704	444.6		0.
7705	360.4	1977	0.
7706	424.1		0.
7707	306.5		0.
7708	118.7		0.
7709	606.1		0.
7710	200.9		0.
7711	296.8		0.
7712	53.00		0.
`01	574.9		0.
02	303.0		0.
03	350.4		0.
7804	171.3		0.
7805	659.4	1978	0.
7806	319.2		0.
7807	491.1		0.
7808	406.5		0.
7809	532.9		0.
7810	209.8		0.
7811	174.7		0.
7812	335.0		0.
7901	250.0		0.
7902	213.5		0.
7903	364.1		0.
7904	363.2		0.
7905	612.0	1979	0.
7906	192.8		0.
7907	470.1		0.
7908	265.8		0.
7909	262.4		0.
7910	743.2		0.
7911	762.4		0.
7912	160.8		0.
8001	684.7		0.
8002	394.3		0.
03	356.7		0.
04	234.5		0.
05	294.2	1980	0.
8006	102.0		0.
8007	94.60		0.
8008	402.1		0.
8009	313.1		0.

PLOT ◆=ACTUAL +=FITTED



$ SPECIAL MAGAZINE SPENDING

	E ACTUAL VALUE	FITTED VALUE		PLOT ◆=ACTUAL +=FITTED
	04	0.		
	7605	0.		
	7606	0.	1976	
	7607	0.		
	7608	0.		
	7609	1208.		
	7610	1387.		
	7611	0.		
	7612	0.		
	7701	0.		
	7702	1240.		
	7703	222.9		
	7704	0.		
	7705	0.	1977	
	7706	0.		
	7707	0.		
	7708	0.		
	7709	0.		
	7710	1664.		
	7711	0.		
	7712	0.		
	7801	0.		
	7802	1180.		
	3	0.		
		0.		
	0	0.	1978	
	7806	0.		
	7807	0.		
	7808	0.		
	7809	0.		
	7810	0.		
	7811	0.		
	7812	0.		
	7901	0.		
	7902	833.3		
	7903	0.		
	7904	0.		
	7905	0.	1979	
	7906	0.		
	7907	0.		
	7908	1660.		
	7909	0.		
	7910	0.		
	7911	0.		
	7912	0.		
	8001	0.		
	8002	1242.		
	8003	0.		
	8004	0.		
	5	0.	1980	
	3	0.		
	07	0.		
	8008	0.		
	8009	1669.		



Series - Media Deflators

Source - Marketing and Media Decision
Decisions Publications Inc.

Definition - Monthly deflators for each media type. December 1978 is used as the reference point.

Media Deflators

B.10 Television
B.11 Spot Television
B.12 Network Radio
B.13 Spot Radio
B.14 Newspapers
B.15 Magazines
B.16 Outdoor

	B.9	B.10	B.11	B.12
	SPOT TV DEFLATOR	PRIME TV DEFLATOR	SPOT RADIO DEFLATOR	NETWORK RADIO DEFLATOR
7407	.610000	.420000	.760000	.860000
7408	.560000	.420000	.760000	.880000
7409	.650000	.570000	.760000	.840000
7410	.710000	.690000	.770000	.780000
7411	.710000	.690000	.770000	.820000
7412	.750000	.660000	.770000	.840000
7501	.740000	.570000	.770000	.870000
7502	.680000	.600000	.770000	.830000
7503	.710000	.600000	.780000	.830000
7504	.690000	.570000	.770000	.870000
7505	.710000	.540000	.780000	.880000
7506	.660000	.450000	.780000	.870000
7507	.640000	.390000	.780000	.820000
7508	.620000	.400000	.780000	.810000
7509	.660000	.570000	.790000	.800000
7510	.710000	.680000	.790000	.870000
7511	.740000	.690000	.810000	.800000
7512	.750000	.600000	.810000	.800000
7601	.730000	.590000	.810000	.820000
7602	.740000	.630000	.810000	.790000
7603	.800000	.630000	.810000	.790000
7604	.870000	.640000	.800000	.770000
7605	.900000	.620000	.820000	.780000
7606	.840000	.570000	.820000	.790000
7607	.800000	.530000	.820000	.790000
7608	.800000	.490000	.840000	.770000
7609	.960000	.650000	.840000	.740000
7610	.990000	.790000	.850000	.880000
7611	1.05000	.870000	.850000	.750000
7612	.990000	.740000	.850000	.750000
7701	.910000	.740000	.860000	.840000
7702	.870000	.780000	.860000	.810000
7703	.950000	.810000	.850000	.790000
7704	1.04000	.820000	.850000	.800000
7705	1.01000	.790000	.870000	.810000
7706	.900000	.740000	.870000	.870000
7707	.870000	.600000	.890000	.890000
7708	.830000	.590000	.890000	.880000
7709	.880000	.730000	.890000	.870000
7710	.950000	1.05000	.890000	.980000
7711	1.02000	1.07000	.900000	.870000
7712	1.04000	.860000	.910000	.870000

7801	.980000	.820000	.910000	.91000
7802	.900000	.840000	.910000	.85000
7803	1.01000	.820000	.910000	.840000
7804	.990000	.920000	.920000	.85000
7805	1.09000	.920000	.920000	.83000
7806	1.05000	.800000	.940000	.86000
7807	.970000	.680000	.950000	.91000
7808	.870000	.660000	.970000	.90000
7809	.890000	.880000	.980000	.93000
7810	1.01000	1.17000	.980000	1.11000
7811	1.08000	1.15000	.980000	.91000
7812	1.00000	1.00000	1.00000	1.0000
7901	1.00000	.910000	1.01000	1.05000
7902	.960000	1.02000	1.02000	.96000
7903	1.10000	.930000	1.03000	.960000
7904	1.07000	1.04000	1.04000	.980000
7905	1.16000	1.03000	1.05000	.99000
7906	1.09000	.880000	1.06000	.99000
7907	.890000	.740000	1.07000	.960000
7908	.900000	.740000	1.08000	.99000
7909	.950000	1.04000	1.11000	1.0000
7910	1.26000	1.33000	1.11000	1.14000
7911	1.27000	1.32000	1.12000	1.09000
7912	1.18000	1.13000	1.12000	1.0400
8001	1.02000	.980000	1.13000	1.00000
8002	.980000	1.00000	1.13000	.99000
8003	1.05000	1.03000	1.21000	1.0000
8004	1.09000	1.10000	1.23000	.990000
8005	1.24000	1.12000	1.23000	1.00000
8006	1.06000	1.06000	1.24000	1.1000
8007	.860000	.730000	1.26000	1.18000
8008	.860000	.720000	1.26000	1.13000
8009	.950000	1.06000	1.26000	1.1900

	B.13	B.14	B.15
	NEWSPAPER DEFLATOR	MAGAZINE DEFLATOR	OUTDOOR DEFLATOR
7407	.700000	.790000	.680000
7408	.700000	.800000	.680000
7409	.710000	.800000	.690000
7410	.720000	.810000	.720000
7411	.740000	.810000	.720000
7412	.760000	.810000	.730000
7501	.780000	.830000	.720000
7502	.790000	.830000	.720000
7503	.800000	.830000	.720000
7504	.800000	.850000	.720000
7505	.810000	.850000	.720000
7506	.820000	.850000	.720000
7507	.820000	.850000	.720000
7508	.820000	.840000	.720000
7509	.820000	.850000	.730000
7510	.820000	.830000	.750000
7511	.820000	.840000	.750000
7512	.820000	.850000	.760000
7601	.830000	.840000	.780000
7602	.830000	.840000	.780000
7603	.830000	.840000	.770000
7604	.830000	.850000	.770000
7605	.830000	.850000	.780000
7606	.830000	.850000	.780000
7607	.840000	.850000	.790000
7608	.840000	.850000	.790000
7609	.870000	.850000	.790000
7610	.870000	.850000	.830000
7611	.870000	.880000	.830000
7612	.870000	.890000	.840000
7701	.910000	.890000	.870000
7702	.920000	.900000	.870000
7703	.920000	.900000	.870000
7704	.920000	.900000	.870000
7705	.940000	.900000	.870000
7706	.940000	.910000	.870000
7707	.940000	.910000	.870000
7708	.950000	.900000	.870000
7709	.950000	.910000	.880000
7710	.950000	.920000	.920000
7711	.950000	.940000	.920000
7712	.950000	.950000	.940000

7801	.960000	.960000	.960000
7802	.970000	.990000	.960000
7803	.980000	.990000	.960000
7804	.990000	.990000	.960000
7805	.990000	.990000	.960000
7806	.990000	1.00000	.960000
7807	1.00000	1.01000	.960000
7808	1.00000	1.01000	.960000
7809	1.00000	1.01000	.960000
7810	1.00000	1.01000	.990000
7811	1.00000	1.00000	.990000
7812	1.00000	1.00000	1.00000
7901	1.03000	1.05000	1.08000
7902	1.07000	1.06000	1.08000
7903	1.07000	1.06000	1.08000
7904	1.08000	1.08000	1.08000
7905	1.09000	1.08000	1.08000
7906	1.09000	1.09000	1.08000
7907	1.09000	1.09000	1.08000
7908	1.09000	1.09000	1.09000
7909	1.10000	1.09000	1.12000
7910	1.12000	1.09000	1.09000
7911	1.13000	1.10000	1.09000
7912	1.14000	1.10000	1.08000
8001	1.20000	1.15000	1.19000
8002	1.21000	1.16000	1.19000
8003	1.22000	1.17000	1.19000
8004	1.23000	1.17000	1.19000
8005	1.25000	1.17000	1.19000
8006	1.25000	1.17000	1.20000
8007	1.26000	1.20000	1.21000
8008	1.27000	1.20000	1.2100
8009	1.29000	1.21000	1.23000

DATA APPENDIX C

POLICY VARIABLES

Series - Recruiter Objectives

Source - General Research Corporation
ELIM - COMPLIP System Documentation

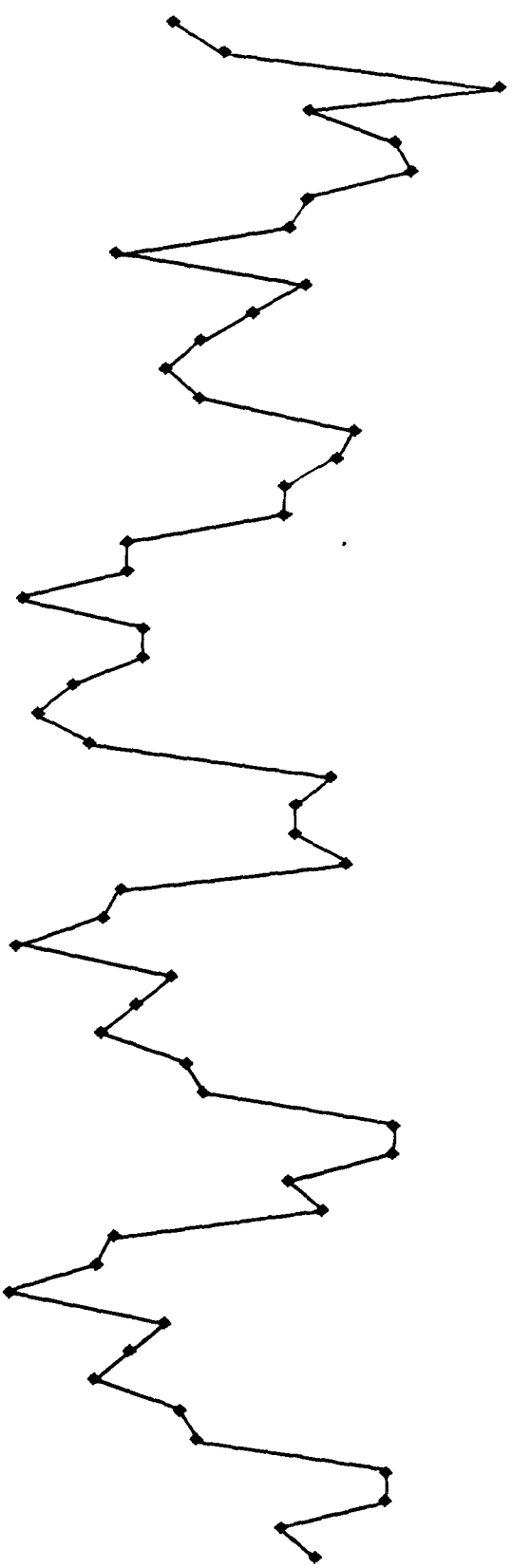
Definition - The monthly male accession objective by month

C.1

RECRUITER OBJECTIVES
(ACCESSIONS)

TE	ACTUAL VALUE	FITTED VALUE
.04	9578.	0.
7605	.1106E+05	0.
7606	.2196E+05	0.
7607	.1477E+05	0.
7608	.1825E+05	0.
7609	.1848E+05	0.
7610	.1440E+05	0.
7611	.1424E+05	0.
7612	7650.	0.
7701	.1480E+05	0.
7702	.1240E+05	0.
7703	.1077E+05	0.
7704	9555.	0.
7705	.1045E+05	0.
7706	.1683E+05	0.
7707	.1573E+05	0.
7708	.1395E+05	0.
7709	.1367E+05	0.
7710	8000.	0.
7711	7900.	0.
7712	4200.	0.
7801	8900.	0.
7802	8470.	0.
7803	6250.	0.
04	4510.	0.
05	6880.	0.
806	.1575E+05	0.
7807	.1467E+05	0.
7808	.1460E+05	0.
7809	.1643E+05	0.
7810	7926.	0.
7811	7126.	0.
7812	4148.	0.
7901	9721.	0.
7902	8335.	0.
7903	7128.	0.
7904	.1042E+05	0.
7905	.1129E+05	0.
7906	.1874E+05	0.
7907	.1855E+05	0.
7908	.1453E+05	0.
7909	.1610E+05	0.
7910	7926.	0.
7911	7126.	0.
7912	4148.	0.
8001	9721.	0.
8002	8335.	0.
8003	7128.	0.
8004	.1042E+05	0.
05	.1129E+05	0.
6	.1874E+05	0.
07	.1855E+05	0.
8008	.1453E+05	0.
8009	.1610E+05	0.

PLOT ◆=ACTUAL +=FITTED



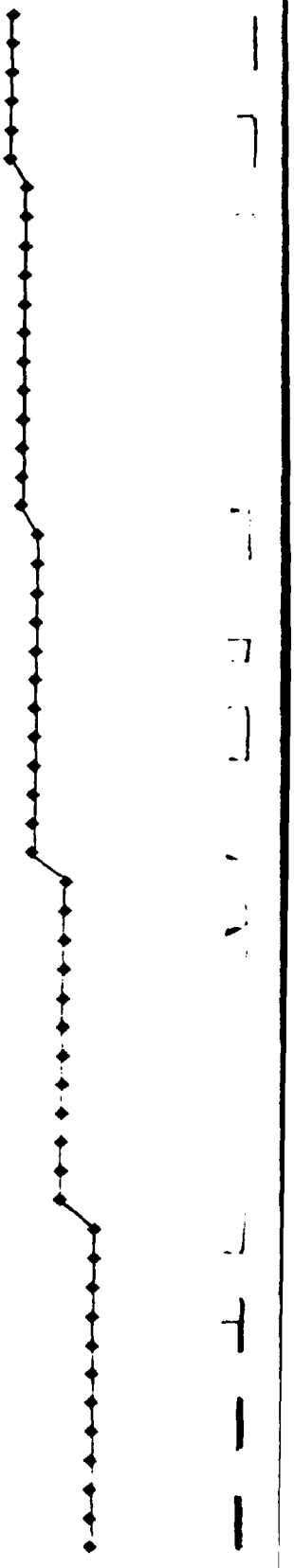
Series - E1 Pay

Source - USAREC

Definition - The monthly pay level for recruits

EI PAY

DATE	ACTUAL VALUE	FITTED VALUE	TEST VARIATIONS	TRANSFORMED
7604	361.2	0.		
7605	361.2	0.		
7606	361.2	0.		
7607	361.2	0.		
7608	361.2	0.		
7609	361.2	0.		
7610	374.4	0.		
7611	374.4	0.		
7612	374.4	0.		
7701	374.4	0.		
7702	374.4	0.		
7703	374.4	0.		
7704	374.4	0.		
7705	374.4	0.		
7706	374.4	0.		
7707	374.4	0.		
7708	374.4	0.		
7709	374.4	0.		
7710	397.5	0.		
7711	397.5	0.		
7712	397.5	0.		
7801	397.5	0.		
7802	397.5	0.		
7803	397.5	0.		
7804	397.5	0.		
7805	397.5	0.		
7806	397.5	0.		
7807	397.5	0.		
7808	397.5	0.		
7809	397.5	0.		
7810	419.4	0.		
7811	419.4	0.		
7812	419.4	0.		
7901	419.4	0.		
7902	419.4	0.		
7903	419.4	0.		
7904	419.4	0.		
7905	419.4	0.		
7906	419.4	0.		
7907	419.4	0.		
7908	419.4	0.		
7909	419.4	0.		
7910	448.0	0.		
7911	448.0	0.		
7912	448.0	0.		
8001	448.0	0.		
8002	448.0	0.		
8003	448.0	0.		
8004	448.0	0.		
8005	448.0	0.		
8006	448.0	0.		
8007	448.0	0.		
8008	448.0	0.		
8009	448.0	0.		



Series - Production Recruiters

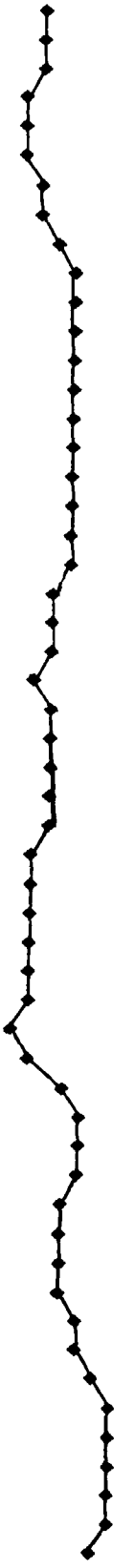
Source - USAREC

Definition - The total number of Army recruiting station commanders and recruiters on production each month

PRODUCTION RECRUITERS

)4	4739.	0.
.05	4734.	0.
7606	4710.	0.
7607	4607.	0.
7608	4591.	0.
7609	4578.	0.
7610	4667.	0.
7611	4758.	0.
7612	4894.	0.
7701	4982.	0.
7702	4999.	0.
7703	5018.	0.
7704	5000.	0.
7705	5042.	0.
7706	5066.	0.
7707	5016.	0.
7708	5056.	0.
7709	5030.	0.
7710	5019.	0.
7711	4997.	0.
7712	4931.	0.
7801	4892.	0.
7802	4850.	0.
7803	4776.	0.
~804	4855.	0.
)5	4884.	0.
)6	4845.	0.
.807	4832.	0.
7808	4835.	0.
7809	4797.	0.
7810	4790.	0.
7811	4771.	0.
7812	4765.	0.
7901	4681.	0.
7902	4642.	0.
7903	4638.	0.
7904	4789.	0.
7905	5018.	0.
7906	5248.	0.
7907	5277.	0.
7908	5244.	0.
7909	5125.	0.
7910	5031.	0.
7911	4993.	0.
7912	5025.	0.
8001	5160.	0.
8002	5180.	0.
8003	5339.	0.
8004	5560.	0.
8005	5569.	0.
`06	5549.	0.
'7	5570.	0.
J8	5544.	0.
8009	5474.	0.

1976 1977 1978 1979 1980



DATA APPENDIX D

ENVIRONMENTAL VARIABLES

Series - Youth Unemployment Rate

Source - U.S. Dept. of Labor (Bur. Labor Statistics)

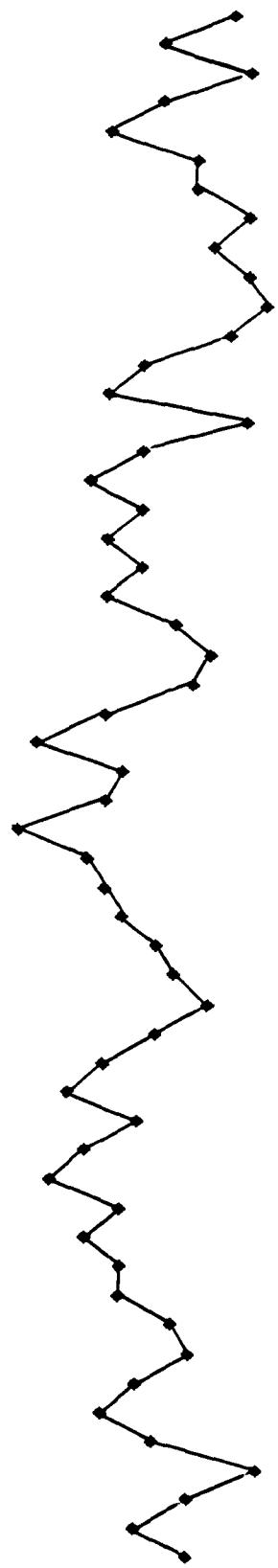
Definition - The non seasonally adjusted unemployment rate among 16-19 year olds

D.1

UNEMPLOYMENT RATE (16-19)

DATE	ACTUAL VALUE	FITTED VALUE
04	19.70	0.
05	17.40	0.
7606	20.40	0.
7607	17.50	0.
7608	15.40	0.
7609	18.50	0.
7610	18.30	0.
7611	20.20	0.
7612	19.40	0.
7701	20.40	0.
7702	21.00	0.
7703	19.90	0.
7704	16.40	0.
7705	15.20	0.
7706	20.30	0.
7707	16.40	0.
7708	14.50	0.
7709	16.80	0.
7710	15.40	0.
7711	16.80	0.
7712	15.10	0.
7801	17.60	0.
7802	19.40	0.
7803	18.20	0.
7804	15.40	0.
05	13.00	0.
6	16.20	0.
07	15.20	0.
7808	12.20	0.
7809	14.90	0.
7810	15.10	0.
7811	16.20	0.
7812	16.90	0.
7901	18.00	0.
7902	19.00	0.
7903	17.50	0.
7904	15.30	0.
7905	13.80	0.
7906	16.60	0.
7907	14.80	0.
7908	13.20	0.
7909	15.60	0.
7910	14.70	0.
7911	16.20	0.
7912	15.90	0.
8001	18.00	0.
8002	18.50	0.
8003	16.40	0.
8004	15.40	0.
8005	17.50	0.
8006	20.80	0.
07	18.30	0.
8	16.40	0.
09	18.30	0.

PLOT ◆=ACTUAL +=FITTED



Series - Civilian Minimum Wage Rate

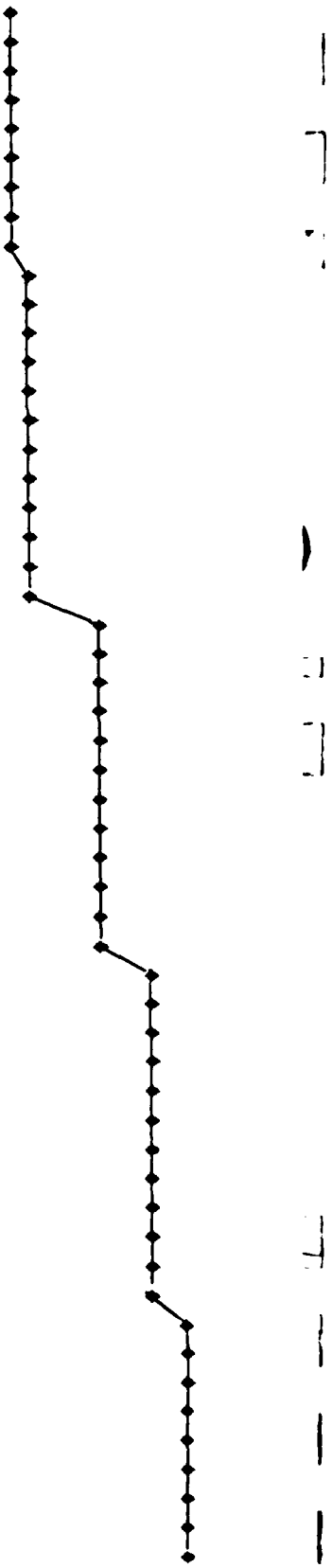
Source - U.S. Department of Labor

Definition - Monthly minimum wage as mandated by Congress

D.2

MINIMUM WAGE

DATE	ACTUAL VALUE		FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
7604	381.3		0.	+
7605	381.3		0.	+
7606	381.3	1976	0.	+
7607	381.3		0.	+
7608	381.3		0.	+
7609	381.3		0.	+
7610	381.3		0.	+
7611	381.3		0.	+
7612	381.3		0.	+
7701	398.7		0.	+
7702	398.7		0.	+
7703	398.7		0.	+
7704	398.7		0.	+
7705	398.7	1977	0.	+
7706	398.7		0.	+
7707	398.7		0.	+
7708	398.7		0.	+
7709	398.7		0.	+
7710	398.7		0.	+
7711	398.7		0.	+
7712	398.7		0.	+
7801	459.3		0.	+
7802	459.3		0.	+
7803	459.3		0.	+
7804	459.3		0.	+
7805	459.3	1978	0.	+
7806	459.3		0.	+
7807	459.3		0.	+
7808	459.3		0.	+
7809	459.3		0.	+
7810	459.3		0.	+
7811	459.3		0.	+
7812	459.3		0.	+
7901	502.7		0.	+
7902	502.7		0.	+
7903	502.7		0.	+
7904	502.7		0.	+
7905	502.7	1979	0.	+
7906	502.7		0.	+
7907	502.7		0.	+
7908	502.7		0.	+
7909	502.7		0.	+
7910	502.7		0.	+
7911	502.7		0.	+
7912	502.7		0.	+
8001	537.3		0.	+
8002	537.3		0.	+
8003	537.3		0.	+
8004	537.3		0.	+
8005	537.3	1980	0.	+
8006	537.3		0.	+
8007	537.3		0.	+
8008	537.3		0.	+
8009	537.3		0.	+



DATA APPENDIX E

PERFORMANCE VARIABLES (TRANSFORMED)

Series - Accession by Date of Contract

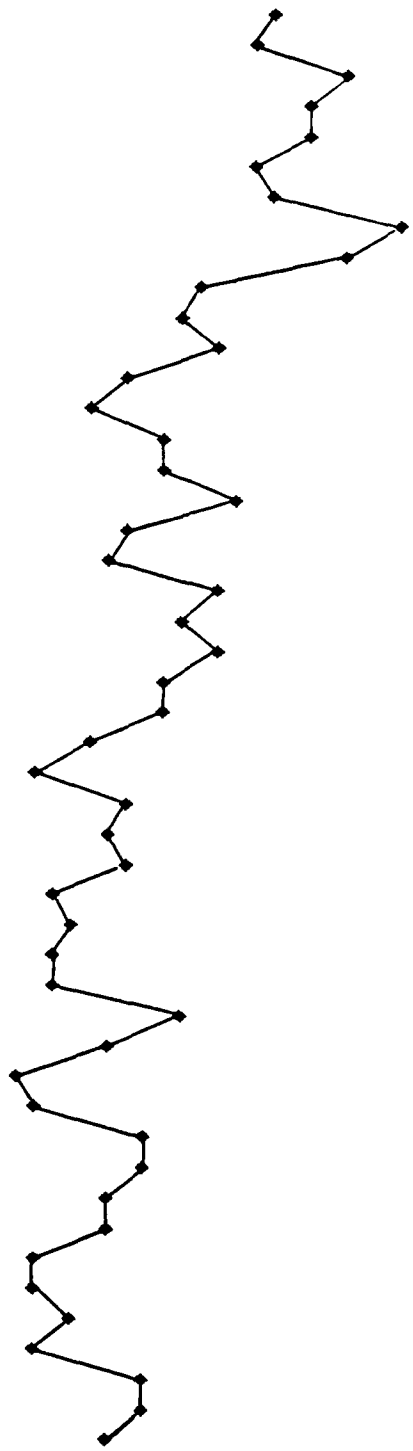
Transformation - The December 1976 value which reflected the impact of the GI Bill termination was replaced by the mean of the series from April 1976 through December 1976.

E.1 High School Degree/Category I-IIIA
E.2 High School Degree/Category IIIB-IV
E.3 Non Degree/Category I-IIIA
E.4 Non Degree/Category I-IIIA

E.1

HSDG/CATEGORY I-IIIA ACCESSIONS
(CONTRACT DATE)
DEC. 76 ADJUSTMENT

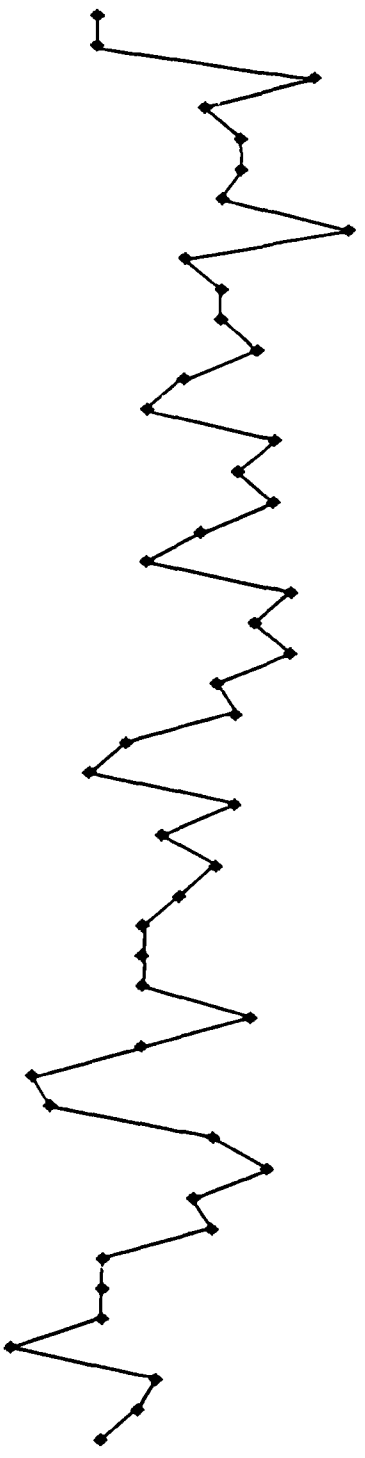
DATE	ACTUAL VALUE	FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
7604	3531.	0.	
7605	3437.	0.	
7606	4162.	0.	1976
7607	3884.	0.	
7608	3842.	0.	
7609	3465.	0.	
7610	3503.	0.	
7611	4508.	0.	
7612	4144.	0.	
7701	2954.	0.	
7702	2855.	0.	
7703	3149.	0.	1977
7704	2437.	0.	
7705	2226.	0.	
7706	2735.	0.	
7707	2718.	0.	
7708	3236.	0.	
7709	2507.	0.	
7710	2350.	0.	
7711	3168.	0.	
12	2889.	0.	
01	3148.	0.	
7802	2770.	0.	1978
7803	2782.	0.	
7804	2132.	0.	
7805	1721.	0.	
7806	2459.	0.	
7807	2276.	0.	
7808	2481.	0.	
7809	1969.	0.	
7810	1985.	0.	
7811	1978.	0.	
7812	1919.	0.	
7901	2808.	0.	
7902	2317.	0.	
7903	1629.	0.	1979
7904	1804.	0.	
7905	2564.	0.	
7906	2568.	0.	
7907	2311.	0.	
7908	2321.	0.	
7909	1742.	0.	
7910	1832.	0.	
7911	1992.	0.	
7912	1760.	0.	
01	2621.	0.	
2	2603.	0.	1980
03	2287.	0.	



1906/Q7 1-3A COUNTRACTS (SAKS 007)

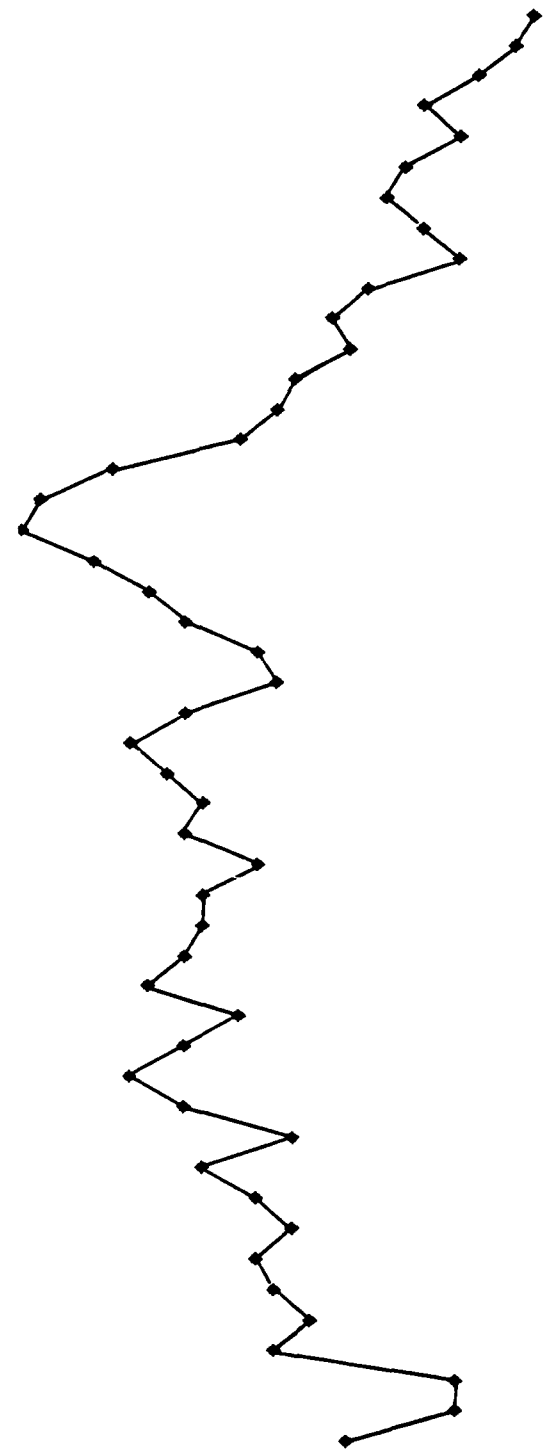
HSDG/CATEGORY IIIB-IV ACCESSIONS
(CONTRACT DATE)
DEC. 76 ADJUSTMENT

DATE	ACTUAL VALUE	FITTED VALUE	PLOT ♦=ACTUAL
7604	2683.	0.	
7605	2646.	0.	
7606	4287.	0.	
7607	3421.	0.	1976
7608	3729.	0.	
7609	3789.	0.	
7610	3672.	0.	
7611	4589.	0.	
7612	3292.	0.	
7701	3632.	0.	
7702	3550.	0.	
7703	3857.	0.	
7704	3276.	0.	1977
7705	3080.	0.	
7706	4000.	0.	
7707	3793.	0.	
7708	4097.	0.	
7709	3496.	0.	
7710	3120.	0.	
7711	4154.	0.	
7712	3855.	0.	
01	4177.	0.	
02	3560.	0.	
03	3770.	0.	1978
7804	2861.	0.	
7805	2621.	0.	
7806	3731.	0.	
7807	3152.	0.	
7808	3611.	0.	
7809	3268.	0.	
7810	3049.	0.	
7811	3091.	0.	
7812	3019.	0.	
7901	3842.	0.	
7902	3038.	0.	
7903	2189.	0.	
7904	2384.	0.	1979
7905	3567.	0.	
7906	3990.	0.	
7907	3462.	0.	
7908	3555.	0.	
7909	2840.	0.	
7910	2798.	0.	
7911	2801.	0.	
7912	2141.	0.	
8001	3248.	0.	
8002	3021.	0.	
03	2755.	0.	1980



NHSDC/CATEGORY I-IIIA ACCESSIONS
(CONTRACT DATE)
DEC. 76 ADJUSTMENT

E	ACTUAL VALUE	FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
7604	2798.	0.	
7605	2671.	0.	
7606	2583.	0.	
7607	2278.	0.	1976
7608	2445.	0.	
7609	2213.	0.	
7610	2114.	0.	
7611	2317.	0.	
7612	2494.	0.	
7701	2022.	0.	
7702	1898.	0.	
7703	1927.	0.	
7704	1732.	0.	1977
7705	1627.	0.	
7706	1483.	0.	
7707	871.0	0.	
7708	491.0	0.	
7709	464.0	0.	
7710	732.0	0.	
7711	1005.	0.	
7712	1228.	0.	
7801	1525.	0.	
7802	1601.	0.	
03	1204.	0.	1978
04	940.0	0.	
7805	1087.	0.	
7806	1250.	0.	
7807	1225.	0.	
7808	1487.	0.	
7809	1276.	0.	
7810	1270.	0.	
7811	1205.	0.	
7812	1039.	0.	
7901	1461.	0.	
7902	1223.	0.	
7903	891.0	0.	1979
7904	1188.	0.	
7905	1700.	0.	
7906	1239.	0.	
7907	1556.	0.	
7908	1736.	0.	
7909	1503.	0.	
7910	1630.	0.	
7911	1791.	0.	
7912	1577.	0.	
8001	2463.	0.	
8002	431.	0.	1980
8003	939.	0.	



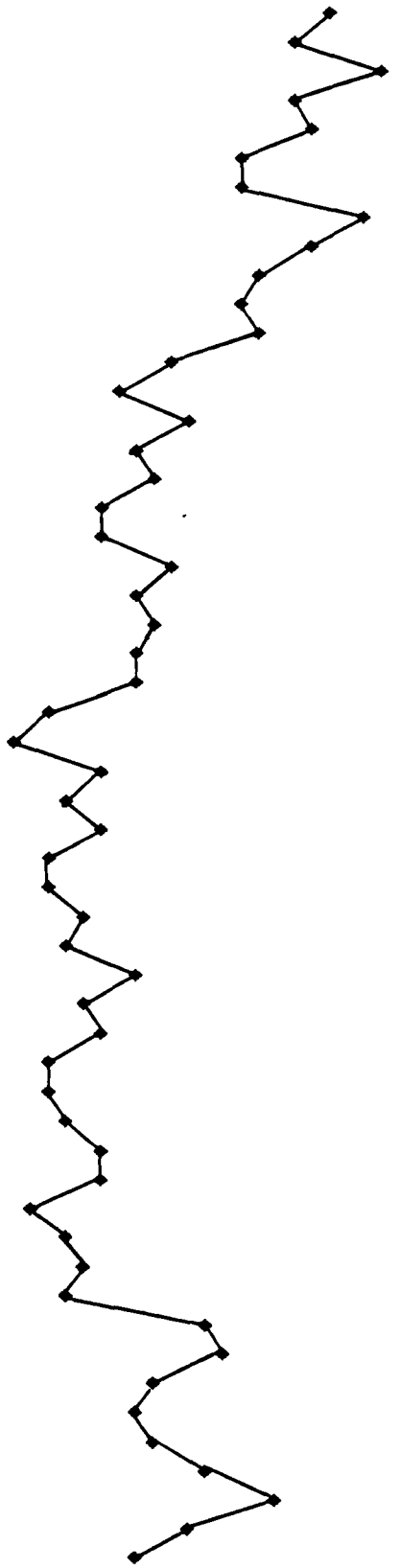
Series - Monthly ASVAB Exams

Transformation - The December 1976 Number which reflected the impact of the GI Bill termination was replaced by the mean of the series from April 1976 through December 1976.

E.4 Category I-IIIA
E.5 Category IIIB-IV

CATEGORY I-IIIA EXAMS
DEC. 76 ADJUSTMENT

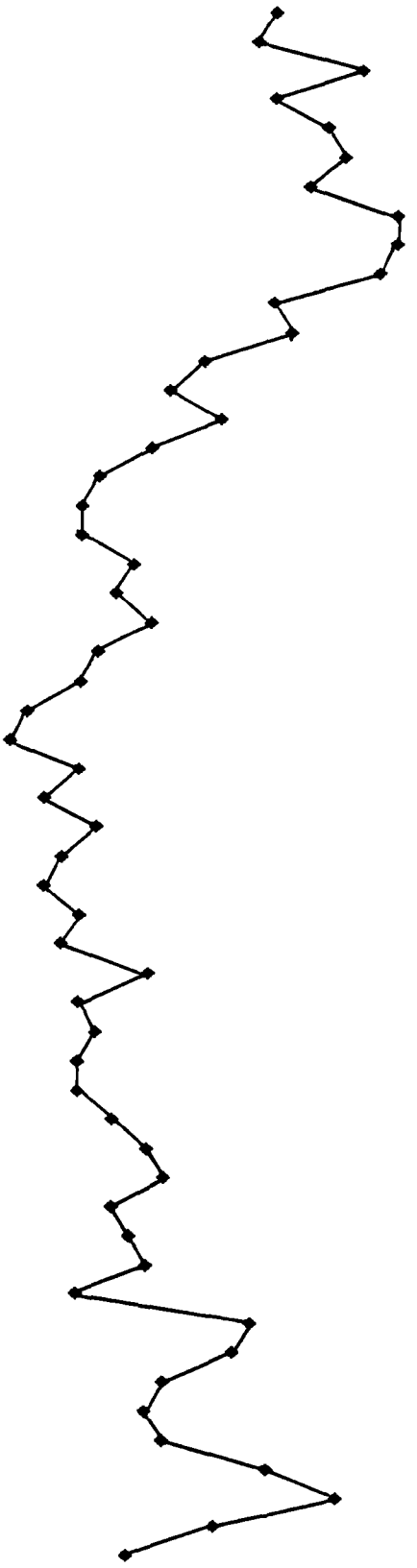
?TE	ACTUAL VALUE	FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
J4	.1021E+05	0.	
,605	9425.	0.	
7606	.1123E+05	0.	1976
7607	9672.	0.	
7608	9754.	0.	
7609	8566.	0.	
7610	8514.	0.	
7611	.1100E+05	0.	
7612	9798.	0.	
7701	8913.	0.	
7702	8627.	0.	
7703	8882.	0.	
7704	7127.	0.	
7705	6168.	0.	
7706	7321.	0.	1977
7707	6594.	0.	
7708	6969.	0.	
7709	5659.	0.	
7710	5809.	0.	
7711	7070.	0.	
7712	6495.	0.	
7801	6867.	0.	
7802	6377.	0.	
7803	6428.	0.	
04	4844.	0.	
5	4092.	0.	
06	5618.	0.	1978
7807	5000.	0.	
7808	5793.	0.	
7809	4757.	0.	
7810	4798.	0.	
7811	5380.	0.	
7812	5003.	0.	
7901	6623.	0.	
7902	5584.	0.	
7903	5815.	0.	
7904	4770.	0.	
7905	4742.	0.	
7906	4963.	0.	1979
7907	5900.	0.	
7908	5753.	0.	
7909	4502.	0.	
7910	4955.	0.	
7911	5456.	0.	
7912	4969.	0.	
8001	7939.	0.	
8002	8073.	0.	
8003	6826.	0.	
8004	6586.	0.	
005	6677.	0.	1980
06	7716.	0.	
07	9163.	0.	
008	7605.	0.	
8009	6568.	0.	



CATEGORY IIIB-IV EXAMS
DEC. 76 ADJUSTMENT

'E	ACTUAL VALUE	FITTED VALUE
7604	.1738E+05	0.
7605	.1659E+05	0.
7606	.2094E+05	0.
7607	.1730E+05	0.
7608	.1930E+05	0.
7609	.2003E+05	0.
7610	.1905E+05	0.
7611	.2225E+05	0.
7612	.2200E+05	0.
7701	.2169E+05	0.
7702	.1730E+05	0.
7703	.1794E+05	0.
7704	.1509E+05	0.
7705	.1349E+05	0.
7706	.1584E+05	0.
7707	.1249E+05	0.
7708	.1112E+05	0.
7709	.1008E+05	0.
7710	.1022E+05	0.
7711	.1192E+05	0.
7712	.1123E+05	0.
7801	.1257E+05	0.
7802	.1104E+05	0.
03	.1014E+05	0.
04	7940.	0.
7805	7537.	0.
7806	9911.	0.
7807	8890.	0.
7808	.1052E+05	0.
7809	9161.	0.
7810	9015.	0.
7811	.1032E+05	0.
7812	9706.	0.
7901	.1293E+05	0.
7902	.1008E+05	0.
7903	.1105E+05	0.
7904	9807.	0.
7905	.1014E+05	0.
7906	.1165E+05	0.
7907	.1305E+05	0.
7908	.1360E+05	0.
7909	.1127E+05	0.
7910	.1232E+05	0.
7911	.1248E+05	0.
7912	.1005E+05	0.
8001	.1718E+05	0.
8002	.1647E+05	0.
8003	.1319E+05	0.
04	.1298E+05	0.
05	.1344E+05	0.
06	.1767E+05	0.
8007	.2054E+05	0.
8008	.1530E+05	0.
8009	.1181E+05	0.

PLOT ◆=ACTUAL +=FITTED



DATA APPENDIX F

MEDIA VARIABLES (TRANSFORMED)

Series - Net and Deflated Media Spending Variables

Transformation - All media series were deflated by the appropriate deflators. The data from April 1976 through September 1978 had been expressed as gross expenditures and needed to be divided by 1.15 to achieve net expenditures.

F.1 Television*
F.2 Radio**
F.3 Newspaper
F.4 Outdoor
F.5 Direct Mail
F.6 Local Advertising
F.7 Regular Magazines
F.8 Special Magazines

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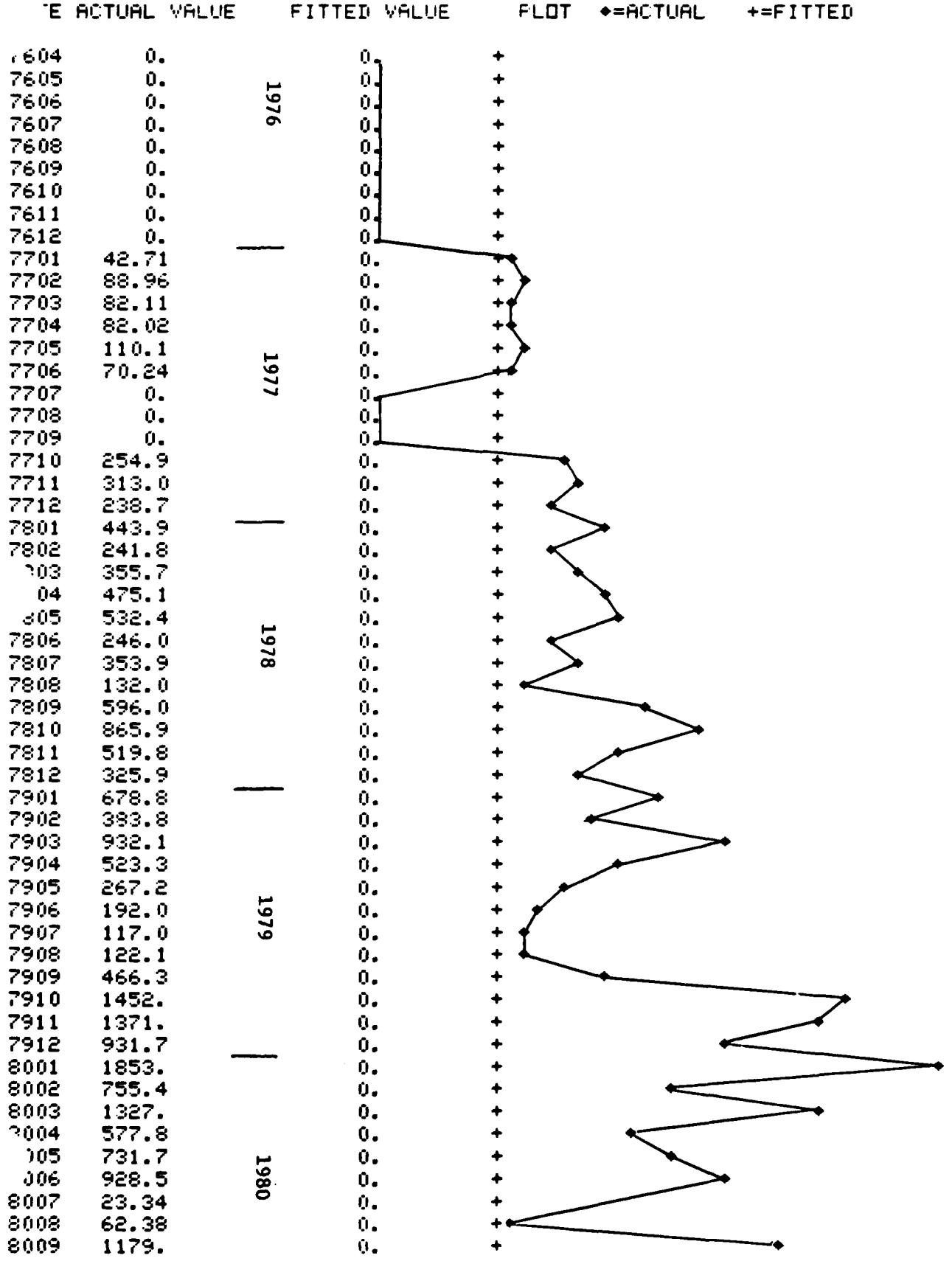
* The TV deflator is a weighted average of the TV spot deflator B.9 and the TV prime deflator B.10. The weights are the proportions of Spot and prime TV to total TV expenditures. We estimated that Spot TV was 100% of total TV expenditures until October 1977; then only 8% until October 1978; and the 25% until October 1980.

** The radio deflator is a similarly weighted average of the radio spot deflator B.11 and the radio network deflator B.12. We estimated that Spot radio was 100% of radio expenditures until October 1976, then 86% until October 1977; and finally 50% until October 1980.

F.1

NET TELEVISION SPENDING
(DEFLATED)

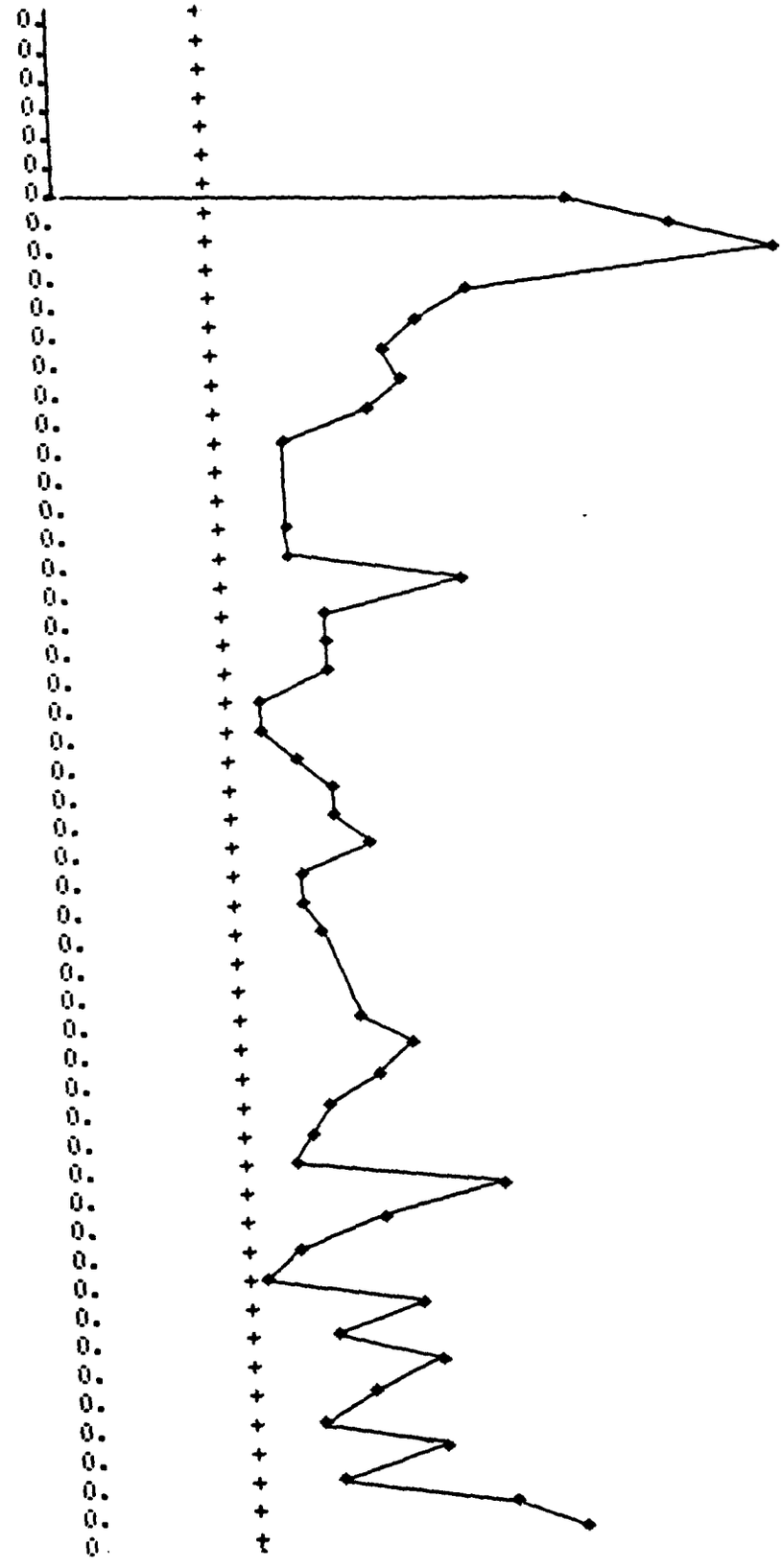


F.2

NET RADIO SPENDING
(DEFLATED)

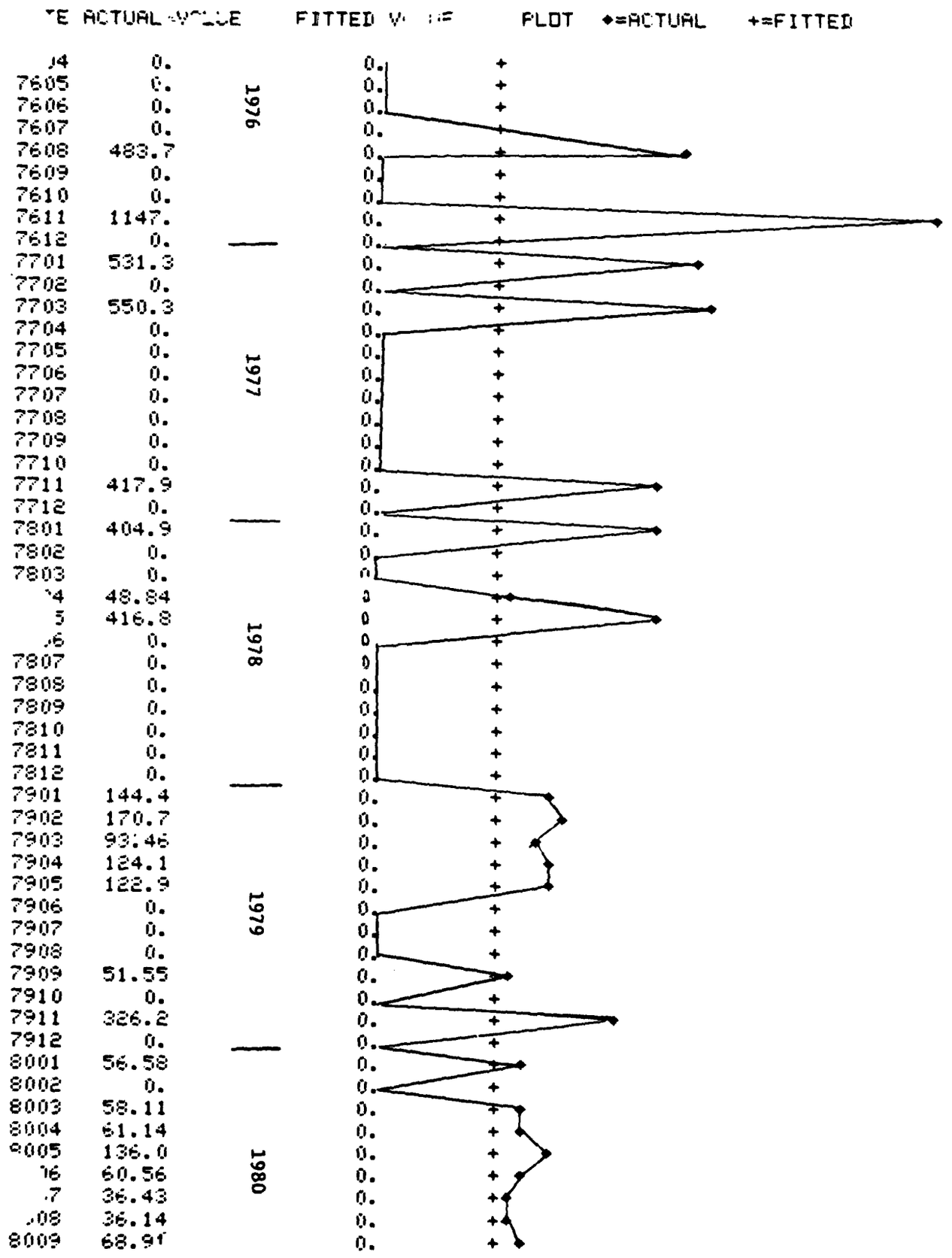
DATE	ACTUAL VALUE	FITTED VALUE
7604	0.	0.
7605	0.	0.
7606	0.	0.
7607	0.	0.
7608	0.	0.
7609	0.	0.
7610	0.	0.
7611	557.9	0.
7612	731.8	0.
7701	897.3	0.
7702	421.0	0.
7703	325.6	0.
7704	262.4	0.
7705	294.7	0.
7706	245.2	0.
7707	120.0	0.
7708	0.	0.
7709	0.	0.
7710	105.4	0.
7711	104.4	0.
7712	374.9	0.
7801	161.5	0.
7802	167.0	0.
7803	168.0	0.
[illegible]04	50.11	0.
[illegible]5	50.68	0.
7806	97.58	0.
7807	165.5	0.
7808	153.5	0.
7809	223.1	0.
7810	103.4	0.
7811	114.4	0.
7812	128.8	0.
7901	0.	0.
7902	0.	0.
7903	182.8	0.
7904	265.5	0.
7905	204.9	0.
7906	143.1	0.
7907	119.1	0.
7908	77.00	0.
7909	416.7	0.
7910	219.6	0.
7911	88.24	0.
7912	22.59	0.
8001	265.2	0.
8002	148.3	0.
8003	306.5	0.
8004	202.9	0.
8005	104.1	0.
[illegible]06	310.8	0.
[illegible]7	122.8	0.
[illegible]8	395.6	0.
[illegible]009	520.1	0.

PLOT ◆=ACTUAL +=FITTED

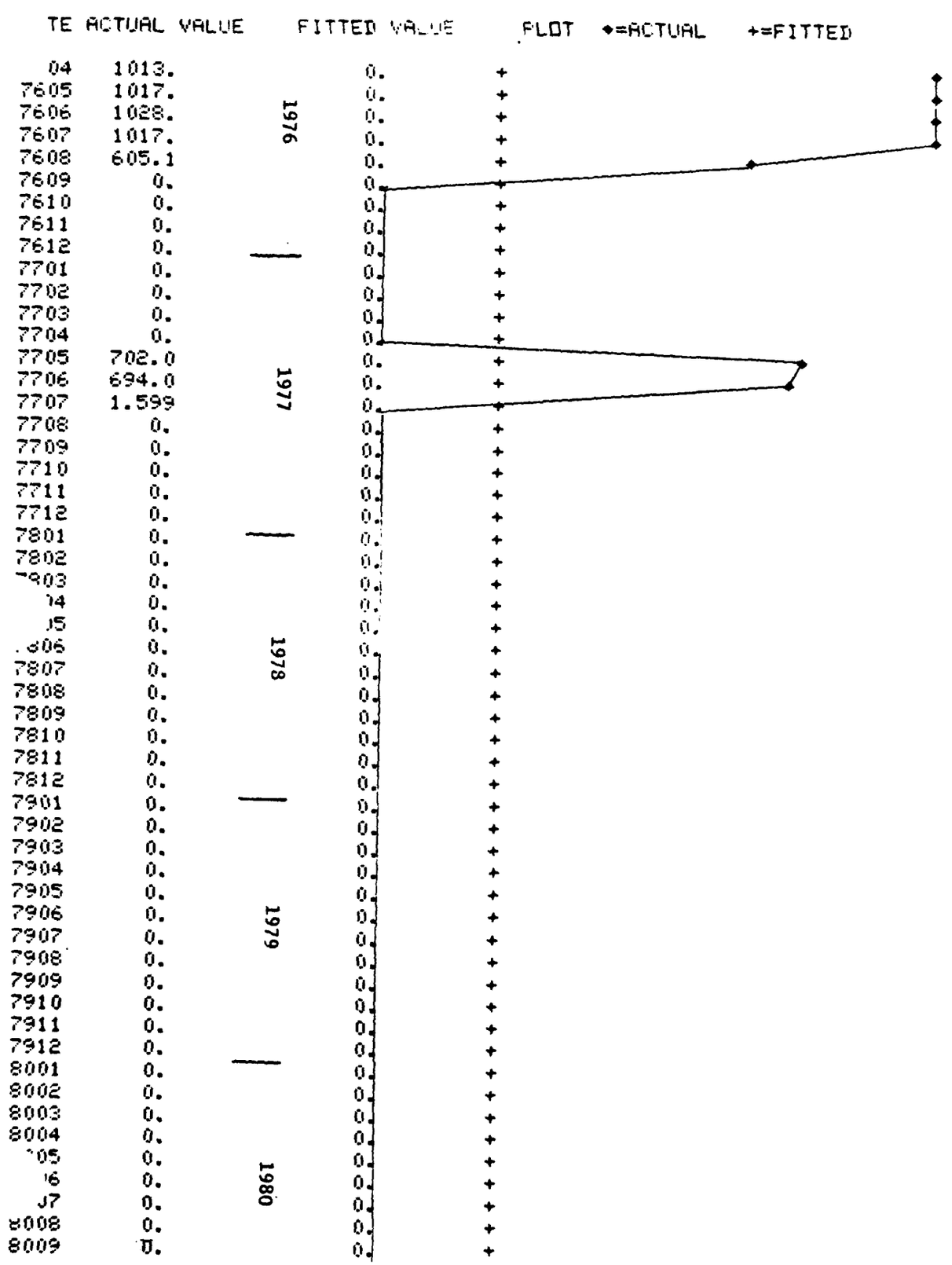


F.3

NET NEWSPAPER SPENDING
(DEFLATED)



F.4
NET OUTDOOR SPENDING
(DEFLATED)

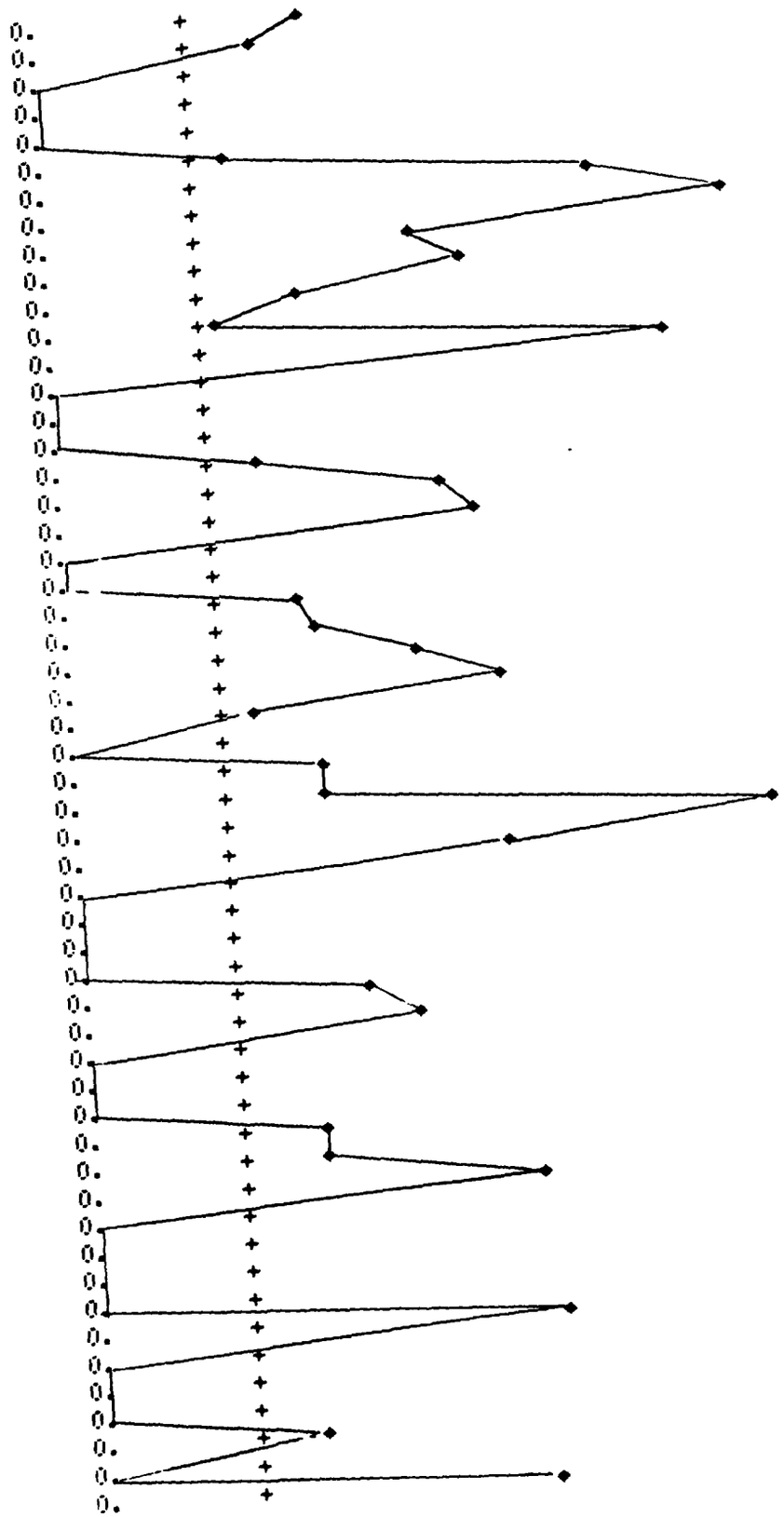


F.5

DIRECT MAIL
(DEFLATED)

*E	ACTUAL VALUE	FITTED VALUE
704	* 186.8	
7605	90.75	
7606	0.	
7607	0.	
7608	0.	
7609	49.50	
7610	610.5	
7611	808.5	
7612	330.0	
7701	396.0	
7702	165.0	
7703	33.00	
7704	726.0	
7705	0.	
7706	0.	
7707	0.	
7708	66.00	
7709	346.5	
7710	396.0	
7711	0.	
7712	0.	
7801	125.4	
7802	165.0	
7803	297.0	
7804	426.7	
7805	49.50	
7806	0.	
7807	165.0	
7808	165.0	
7809	841.5	
7810	445.5	
7811	0.	
7812	0.	
7901	0.	
7902	0.	
7903	197.2	
7904	291.4	
7905	0.	
7906	0.	
7907	0.	
7908	123.7	
7909	123.7	
7910	470.3	
7911	0.	
7912	0.	
8001	0.	
8002	0.	
8003	478.5	
8004	0.	
8005	3.300	
8006	0.	
8007	99.00	
8008	0.	
8009	462.0	

PLOT ◆=ACTUAL +=FITTED

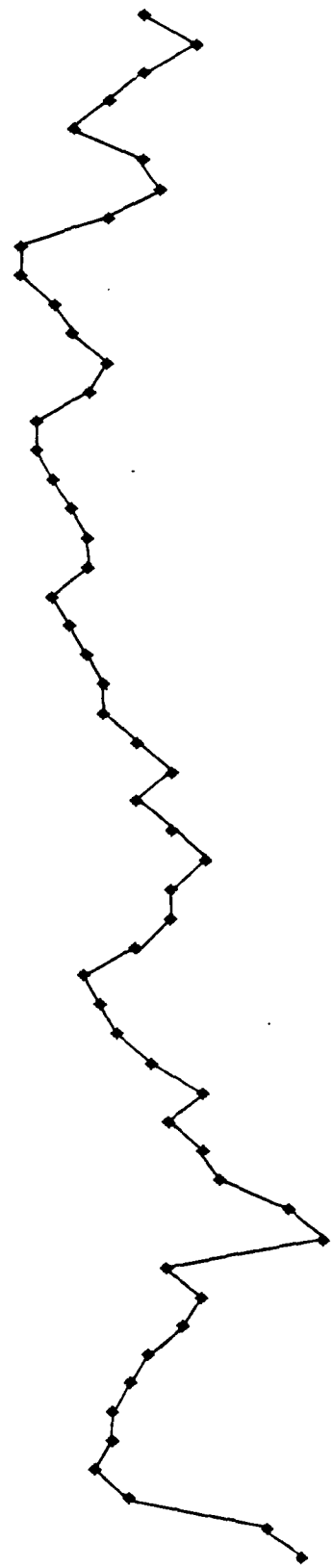


F.6

LOCAL ADVERTISING
(DEFLATED)

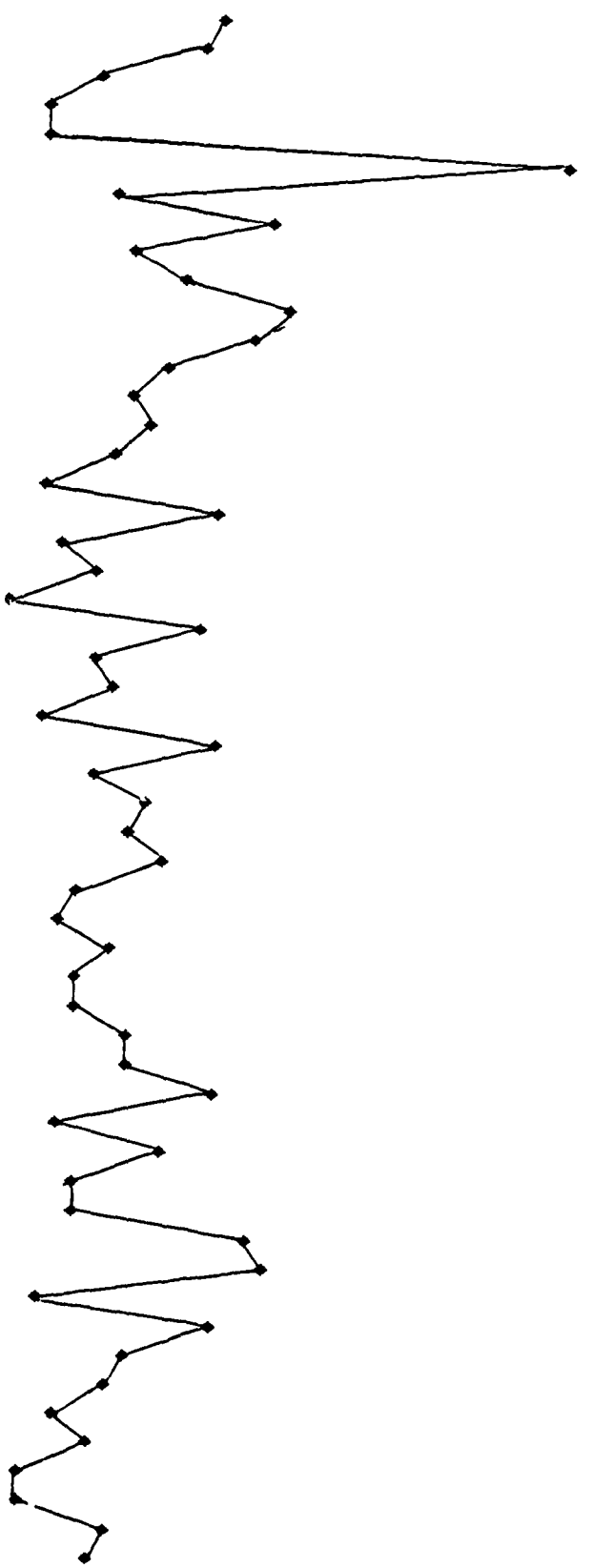
TE	ACTUAL VALUE	FITTED VALUE
7604	351.8	0.
7605	392.3	0.
7606	349.4	0.
7607	319.6	0.
7608	277.3	0.
7609	347.0	0.
7610	355.5	0.
7611	322.3	0.
7612	230.4	0.
7701	231.9	0.
7702	262.2	0.
7703	282.3	0.
7704	308.7	0.
7705	300.5	0.
7706	257.8	0.
7707	246.1	0.
7708	268.6	0.
7709	280.4	0.
7710	302.5	0.
7711	298.1	0.
7712	266.4	0.
7801	276.4	0.
7802	297.2	0.
03	317.4	0.
04	322.2	0.
7805	354.3	0.
7806	374.7	0.
7807	341.4	0.
7808	370.9	0.
7809	402.5	0.
7810	373.4	0.
7811	377.2	0.
7812	347.6	0.
7901	301.4	0.
7902	314.1	0.
7903	335.6	0.
7904	360.8	0.
7905	417.1	0.
7906	377.2	0.
7907	404.9	0.
7908	423.2	0.
7909	495.5	0.
7910	520.3	0.
7911	375.1	0.
7912	408.1	0.
8001	401.4	0.
8002	366.0	0.
8003	345.0	0.
04	326.4	0.
05	323.7	0.
06	310.0	0.
8007	349.2	0.
8008	468.3	0.
8009	503.1	0.

PLOT ◆=ACTUAL +=FITTED



NET REGULAR MAGAZINE SPENDING
(DEFLATED)

DATE	ACTUAL VALUE	FITTED VALUE
04	586.1	0.
7605	532.4	0.
7606	268.4	0.
7607	130.7	0.
7608	116.1	0.
7609	1476.	0.
7610	330.9	0.
7611	732.6	0.
7612	336.9	0.
7701	489.6	0.
7702	752.2	0.
7703	671.2	0.
7704	429.6	0.
7705	348.2	0.
7706	405.3	0.
7707	292.9	0.
7708	114.7	0.
7709	579.2	0.
7710	189.9	0.
7711	274.6	0.
7712	48.51	0.
7801	520.7	0.
7802	266.1	0.
7803	307.8	0.
304	150.5	0.
05	579.2	0.
306	277.6	0.
7807	422.8	0.
7808	350.0	0.
7809	458.8	0.
7810	207.7	0.
7811	174.7	0.
7812	335.0	0.
7901	238.1	0.
7902	201.4	0.
7903	343.5	0.
7904	336.3	0.
7905	566.7	0.
7906	176.9	0.
7907	431.3	0.
7908	243.9	0.
7909	240.7	0.
7910	681.8	0.
7911	693.1	0.
7912	146.2	0.
8001	595.4	0.
8002	339.9	0.
8003	304.9	0.
8004	200.4	0.
8005	251.5	0.
06	87.18	0.
07	78.83	0.
008	335.1	0.
8009	258.8	0.

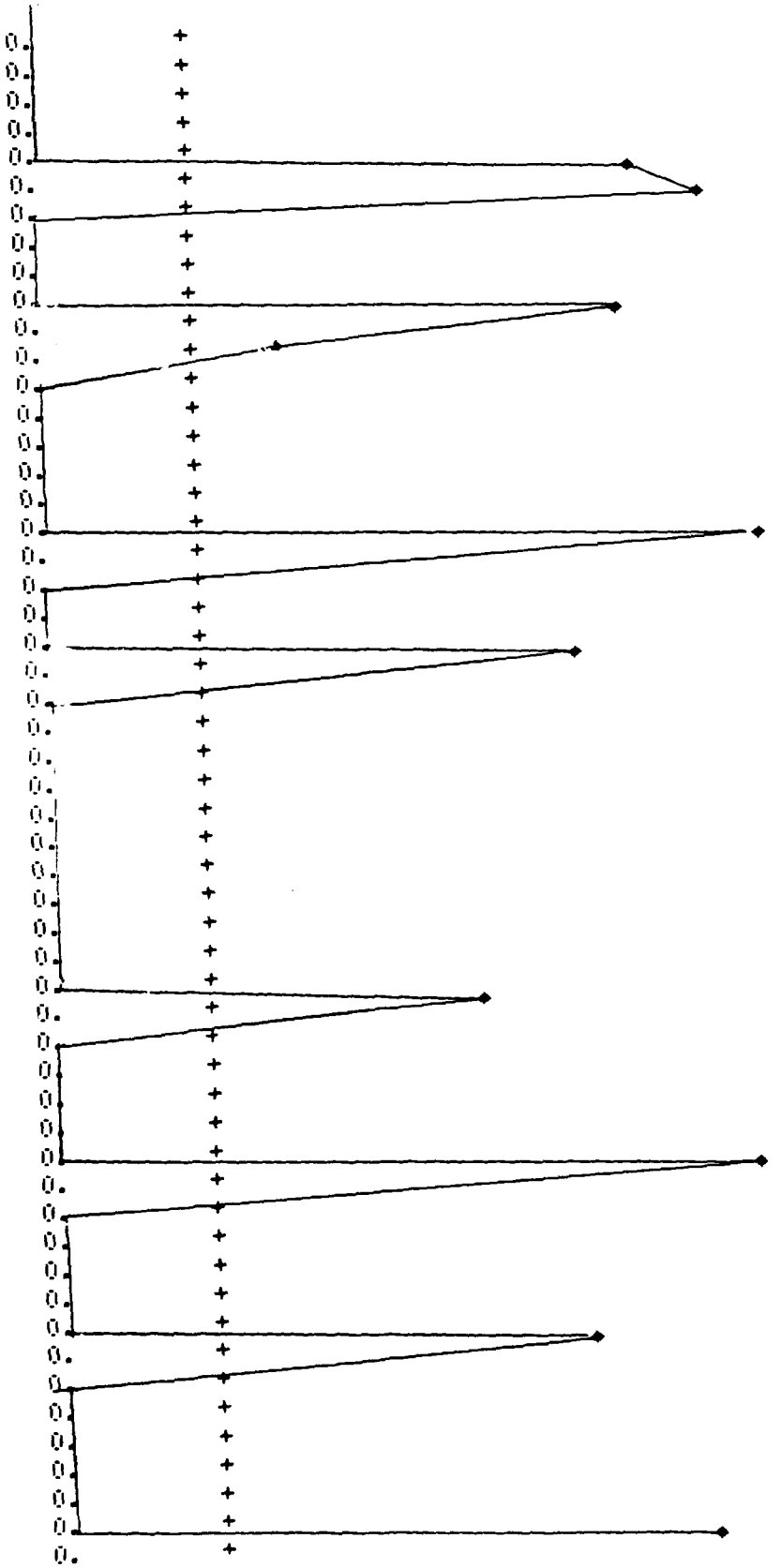


NET SPECIAL MAGAZINE SPENDING
(DEFLATED)

DATE	ACTUAL VALUE	FITTED VALUE
14	0.	
05	0.	
7606	0.	
7607	0.	
7608	0.	
7609	1236.	
7610	1419.	
7611	0.	
7612	0.	
7701	0.	
7702	1198.	
7703	215.4	
7704	0.	
7705	0.	
7706	0.	
7707	0.	
7708	0.	
7709	0.	
7710	1573.	
7711	0.	
7712	0.	
7801	0.	
7802	1036.	
7803	0.	
7804	0.	
15	0.	
06	0.	
7807	0.	
7808	0.	
7809	0.	
7810	0.	
7811	0.	
7812	0.	
7901	0.	
7902	786.1	
7903	0.	
7904	0.	
7905	0.	
7906	0.	
7907	0.	
7908	1523.	
7909	0.	
7910	0.	
7911	0.	
7912	0.	
8001	0.	
8002	1071.	
8003	0.	
8004	0.	
8005	0.	
06	0.	
07	0.	
08	0.	
8009	1379.	

1976 1977 1978 1979 1980

PLOT ◆=ACTUAL +=FITTED



Series - Total Media

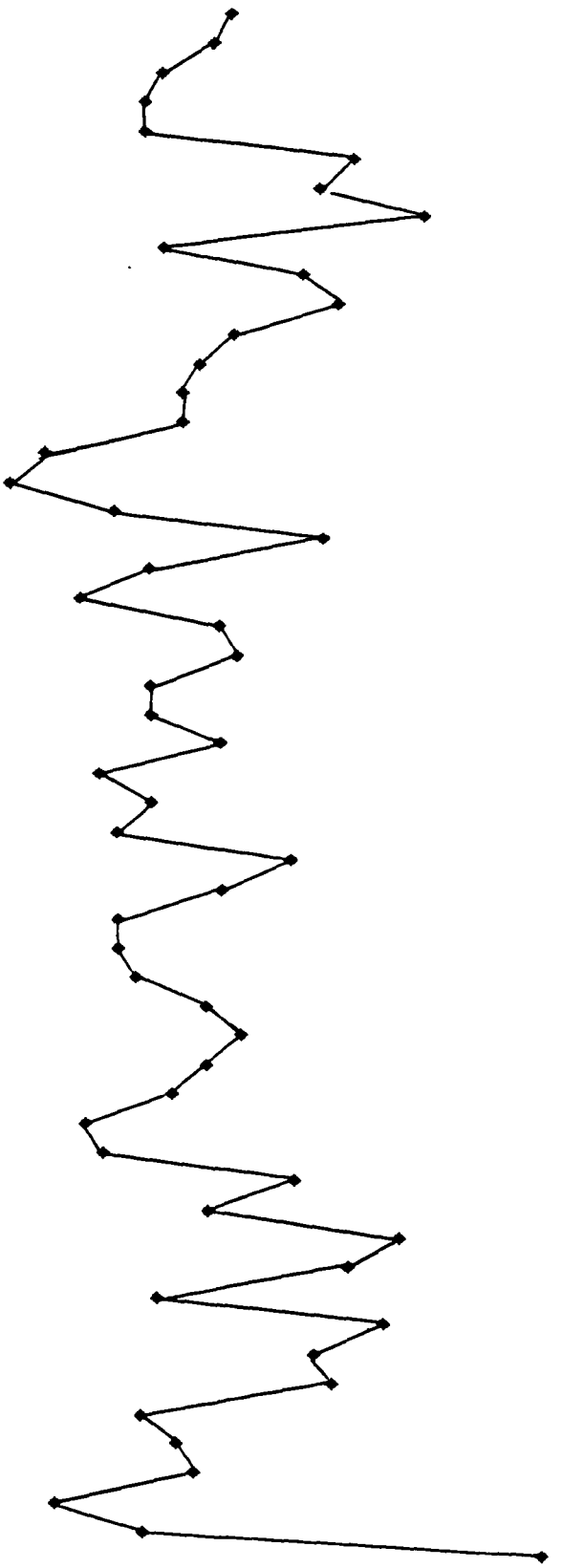
Transformation - The sum of the all eight deflated media expenditures for each month

F.9

TOTAL MEDIA AGGREGATE
CURRENT PERIOD
(DEFLATED)

TE	ACTUAL VALUE	FITTED VALUE	
04	2137.	0.	
7605	2032.	0.	
7606	1646.	0.	1976
7607	1467.	0.	
7608	1482.	0.	
7609	3108.	0.	
7610	2716.	0.	
7611	3568.	0.	
7612	1629.	0.	
7701	2589.	0.	
7702	2887.	0.	
7703	2160.	0.	
7704	1809.	0.	
7705	1756.	0.	
7706	1672.	0.	1977
7707	660.6	0.	
7708	449.3	0.	
7709	1206.	0.	
7710	2822.	0.	
7711	1408.	0.	
7712	928.5	0.	
7801	1933.	0.	
7802	2174.	0.	
03	1446.	0.	
04	1473.	0.	
05	1983.	0.	
7806	995.8	0.	1978
7807	1449.	0.	
7808	1171.	0.	
7809	2522.	0.	
7810	1996.	0.	
7811	1186.	0.	
7812	1137.	0.	
7901	1363.	0.	
7902	1856.	0.	
7903	2085.	0.	
7904	1901.	0.	
7905	1579.	0.	
7906	889.2	0.	1979
7907	1072.	0.	
7908	2513.	0.	
7909	1795.	0.	
7910	3344.	0.	
7911	2854.	0.	
7912	1509.	0.	
8001	3171.	0.	
8002	2680.	0.	
8003	2820.	0.	
8004	1369.	0.	
05	1550.	0.	
06	1697.	0.	1980
07	709.6	0.	
8008	1298.	0.	
8009	4371.	0.	

PLOT ◆=ACTUAL +=FITTED



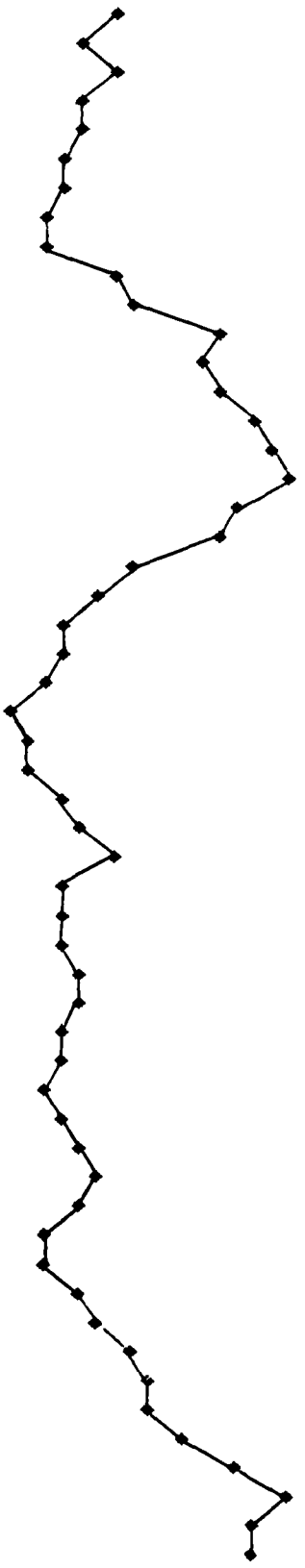
Series - Total Media summed for lags 4 through 11

Transformation - The value at each month is the total media variable summed from lag t-4 through lag t-11.

TOTAL MEDIA AGGREGATE
LAG 4-11
(DEFLATED)

DATE	ACTUAL VALUE	FITTED VALUE	
7604	.1428E+05	0.	
7605	.1322E+05	0.	
7606	.1417E+05	0.	1976
7607	.1292E+05	0.	
7608	.1318E+05	0.	
7609	.1257E+05	0.	
7610	.1246E+05	0.	
7611	.1186E+05	0.	
7612	.1181E+05	0.	
7701	.1429E+05	0.	
7702	.1520E+05	0.	
7703	.1816E+05	0.	
7704	.1765E+05	0.	
7705	.1821E+05	0.	
7706	.1945E+05	0.	1977
7707	.2014E+05	0.	
7708	.2047E+05	0.	
7709	.1911E+05	0.	
7710	.1807E+05	0.	
7711	.1516E+05	0.	
7712	.1398E+05	0.	
7801	.1260E+05	0.	
7802	.1253E+05	0.	
7803	.1178E+05	0.	
7804	.1090E+05	0.	
7805	.1108E+05	0.	
7806	.1158E+05	0.	1978
7807	.1237E+05	0.	
7808	.1339E+05	0.	
7809	.1417E+05	0.	
7810	.1234E+05	0.	
7811	.1238E+05	0.	
7812	.1262E+05	0.	
7901	.1321E+05	0.	
7902	.1304E+05	0.	
7903	.1278E+05	0.	
7904	.1244E+05	0.	
7905	.1182E+05	0.	
7906	.1268E+05	0.	1979
7907	.1332E+05	0.	
7908	.1405E+05	0.	
7909	.1310E+05	0.	
7910	.1200E+05	0.	
7911	.1188E+05	0.	
7912	.1326E+05	0.	
8001	.1369E+05	0.	
8002	.1518E+05	0.	
8003	.1595E+05	0.	
8004	.1555E+05	0.	
8005	.1715E+05	0.	
8006	.1894E+05	0.	1980
8007	.2068E+05	0.	
8008	.1954E+05	0.	
8009	.1930E+05	0.	

PLOT ◆=ACTUAL +=FITTED

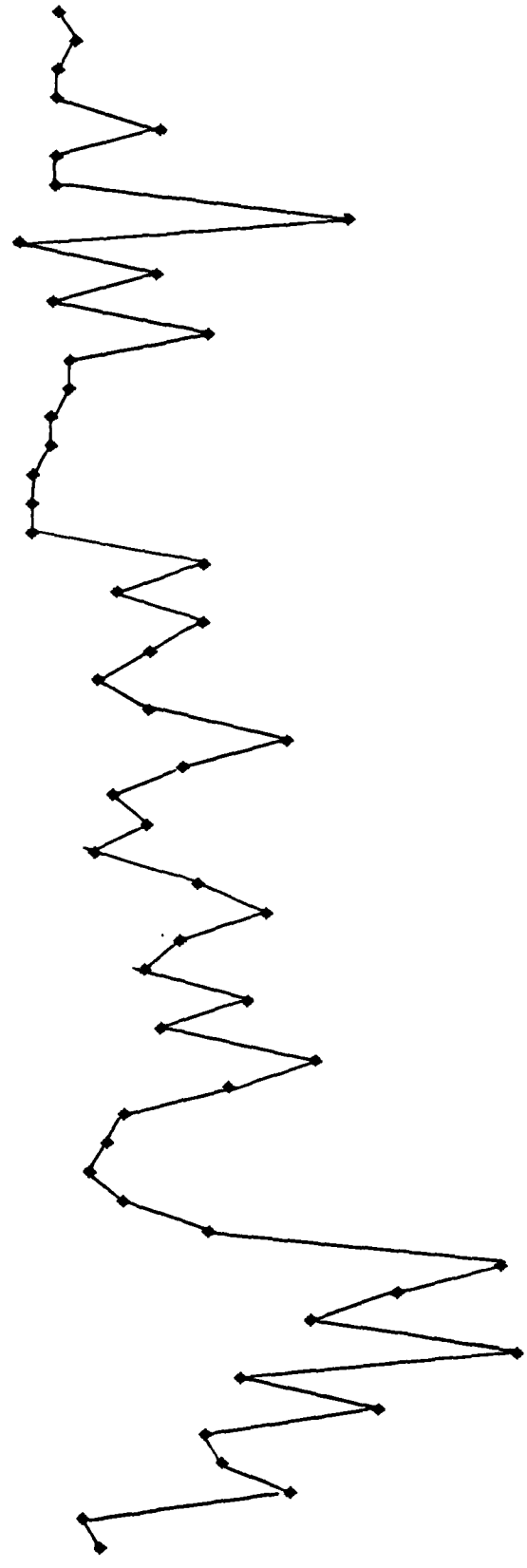


Series - TV, Radio, Local Advertising Aggregate

Transformation - Current value of radio spending + current value of local advertising spending + television spending lagged one period

TV (T-1) + LOCAL + NEWSPAPER SPENDING
(DEFLATED)

DATE	ACTUAL VALUE	FITTED VALUE
)4	351.8	0.
05	392.3	0.
7606	349.4	0.
7607	319.6	0.
7608	761.0	0.
7609	347.0	0.
7610	355.5	0.
7611	1469.	0.
7612	230.4	0.
7701	763.1	0.
7702	304.9	0.
7703	921.5	0.
7704	390.8	0.
7705	382.6	0.
7706	367.9	0.
7707	316.4	0.
7708	268.6	0.
7709	280.4	0.
7710	302.5	0.
7711	970.9	0.
7712	579.4	0.
7801	919.9	0.
7802	741.0	0.
7803	559.2	0.
7804	726.7	0.
)5	1246.	0.
)6	907.1	0.
807	587.4	0.
7808	724.8	0.
7809	534.4	0.
7810	969.4	0.
7811	1243.	0.
7812	867.5	0.
7901	771.6	0.
7902	1164.	0.
7903	812.9	0.
7904	1417.	0.
7905	1063.	0.
7906	644.4	0.
7907	596.9	0.
7908	540.3	0.
7909	669.1	0.
7910	986.6	0.
7911	2153.	0.
7912	1779.	0.
8001	1390.	0.
8002	2219.	0.
8003	1158.	0.
8004	1714.	0.
8005	1037.	0.
)6	1102.	0.
'	1314.	0.
8	527.8	0.
8009	634.4	0.



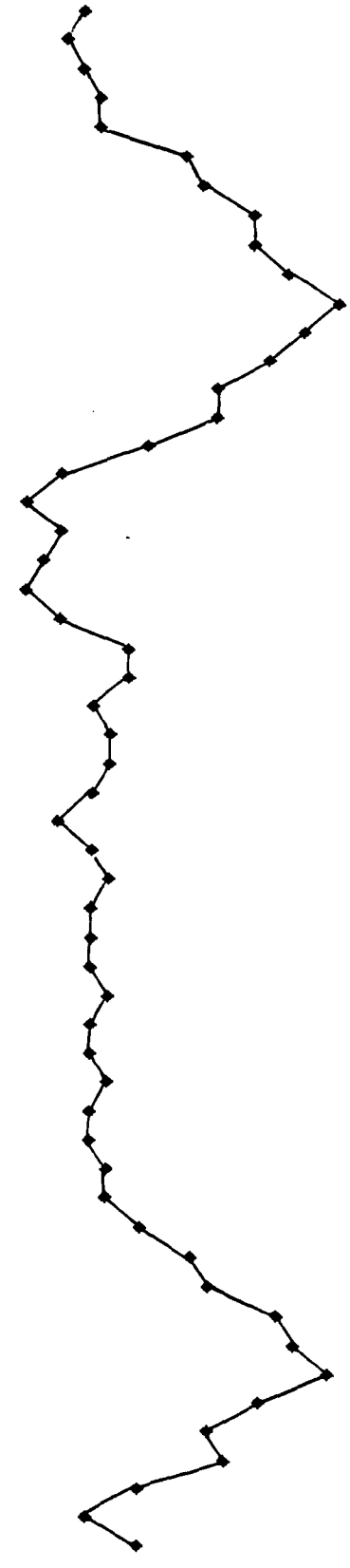
Series - Total Media Sum for current period through lag 5

Transformation - The value at each month is the total media variable summed from the current period through lag t-5.

F.12

TOTAL MEDIA AGGREGATE
LAG 0-5
(DEFLATED)

DATE	ACTUAL VALUE	FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
7604	8783.	0.	
7605	8747.	0.	
7606	8859.	0.	1976
7607	9700.	0.	
7608	9375.	0.	
7609	.1187E+05	0.	
7610	.1245E+05	0.	
7611	.1399E+05	0.	
7612	.1397E+05	0.	
7701	.1509E+05	0.	
7702	.1650E+05	0.	
7703	.1555E+05	0.	
7704	.1464E+05	0.	
7705	.1283E+05	0.	
7706	.1287E+05	0.	1977
7707	.1094E+05	0.	
7708	8506.	0.	
7709	7553.	0.	
7710	8566.	0.	
7711	8218.	0.	
7712	7474.	0.	
7801	8746.	0.	
7802	.1047E+05	0.	
7803	.1071E+05	0.	
7804	9362.	0.	
7805	9937.	0.	
7806	.1000E+05	0.	1978
7807	9520.	0.	
7808	8518.	0.	
7809	9594.	0.	
7810	.1012E+05	0.	
7811	9320.	0.	
7812	9461.	0.	
7901	9375.	0.	
7902	.1006E+05	0.	
7903	9623.	0.	
7904	9528.	0.	
7905	9921.	0.	
7906	9673.	0.	1979
7907	9383.	0.	
7908	.1004E+05	0.	
7909	9749.	0.	
7910	.1119E+05	0.	
7911	.1247E+05	0.	
7912	.1309E+05	0.	
8001	.1518E+05	0.	
8002	.1535E+05	0.	
8003	.1638E+05	0.	
8004	.1440E+05	0.	
8005	.1310E+05	0.	
8006	.1329E+05	0.	1980
8007	.1083E+05	0.	
8008	9443.	0.	
8009	.1099E+05	0.	



DATA APPENDIX G

POLICY VARIABLES (TRANSFORMED)

Series - Recruiter Accession Objectives Smoothed

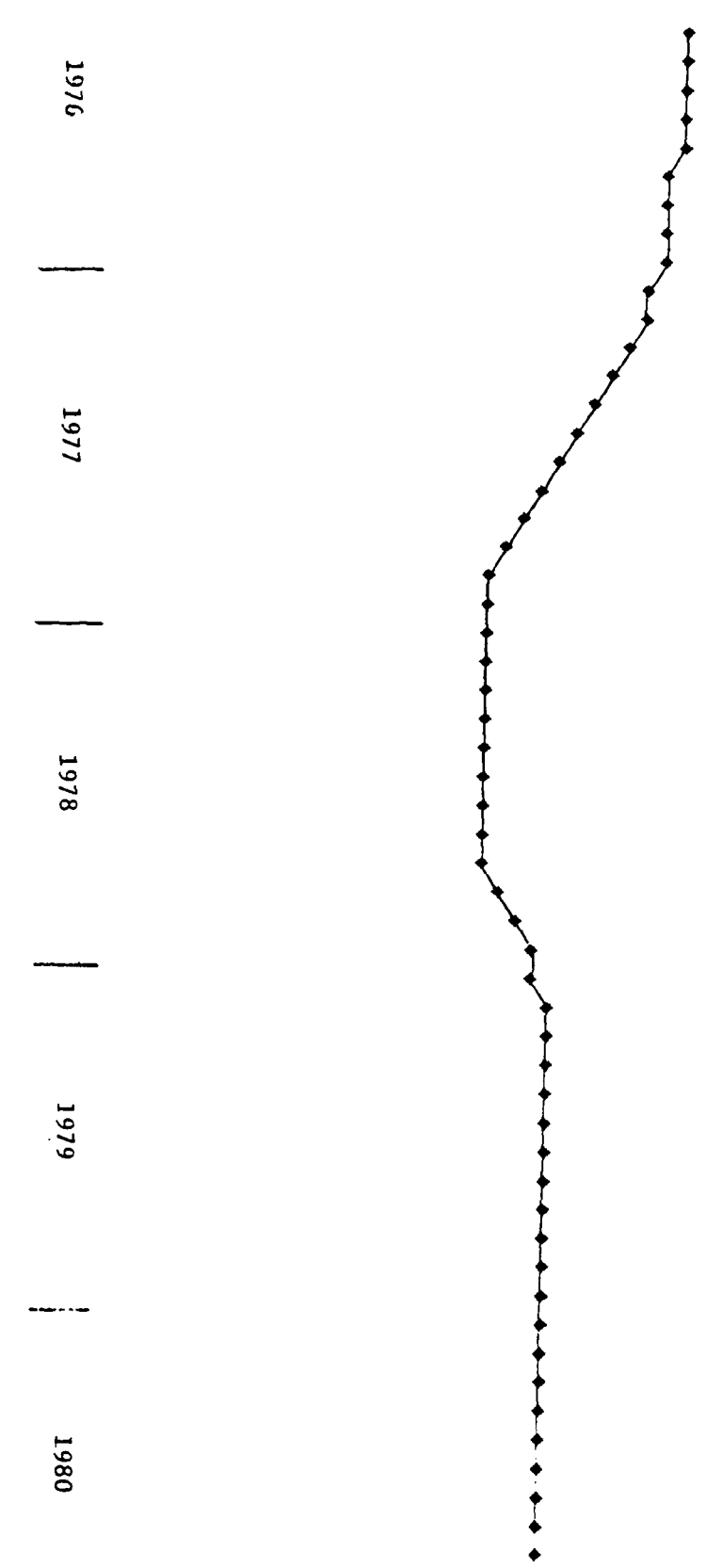
Transformation - A centered twelve month moving average of the accession objective series

Comments - This variable is designed to capture the long term or overall mission component of objectives.

G.1
RECRUITER OBJECTIVES
12 MONTH MOVING AVERAGE

ATE	ACTUAL VALUE	FITTED VALUE
704	.1422E+05	0.
7705	.1432E+05	0.
7706	.1434E+05	0.
7707	.1423E+05	0.
7708	.1413E+05	0.
7709	.1405E+05	0.
7710	.1403E+05	0.
7711	.1400E+05	0.
7712	.1376E+05	0.
7701	.1359E+05	0.
7702	.1345E+05	0.
7703	.1307E+05	0.
7704	.1260E+05	0.
7705	.1207E+05	0.
7706	.1166E+05	0.
7707	.1128E+05	0.
7708	.1087E+05	0.
7709	.1051E+05	0.
7710	.1011E+05	0.
7711	9756.	0.
7712	9562.	0.
7801	9473.	0.
7802	9456.	0.
7803	9598.	0.
14	9710.	0.
05	9675.	0.
806	9640.	0.
7807	9672.	0.
7808	9701.	0.
7809	9732.	0.
7810	.1001E+05	0.
7811	.1044E+05	0.
7812	.1075E+05	0.
7901	.1104E+05	0.
7902	.1120E+05	0.
7903	.1118E+05	0.
7904	.1117E+05	0.
7905	.1117E+05	0.
7906	.1117E+05	0.
7907	.1117E+05	0.
7908	.1117E+05	0.
7909	.1117E+05	0.
7910	.1117E+05	0.
7911	.1117E+05	0.
7912	.1117E+05	0.
8001	.1117E+05	0.
8002	.1117E+05	0.
8003	.1117E+05	0.
8004	.1117E+05	0.
05	.1117E+05	0.
6	.1117E+05	0.
7	.1117E+05	0.
8008	.1117E+05	0.
8009	.11,7E+05	0.

PLOT ◆=ACTUAL +=FITTED



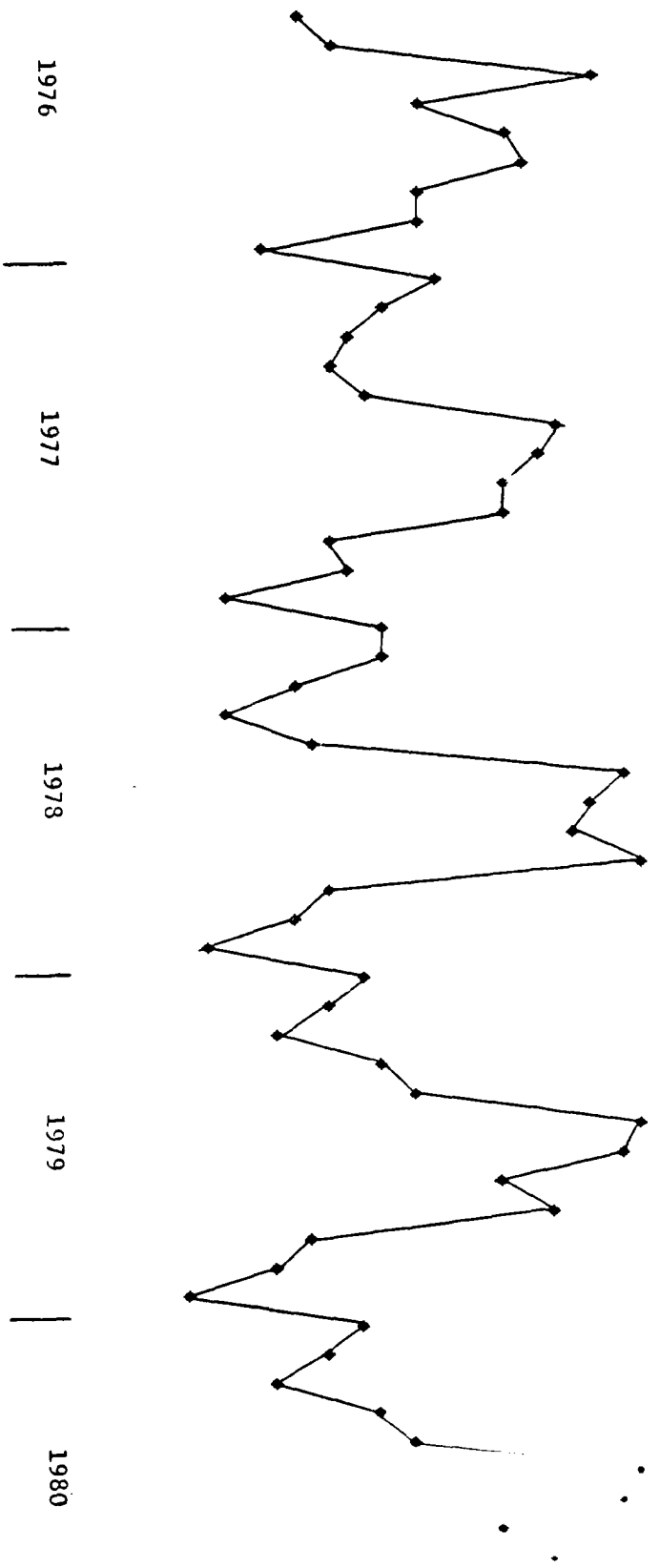
Series - Recruiter Objectives - Monthly Effects

Transformation - The ratio of the accession objective to the smoothed objectives series

Comments - This variable is designed to capture the monthly administration variation in objectives.

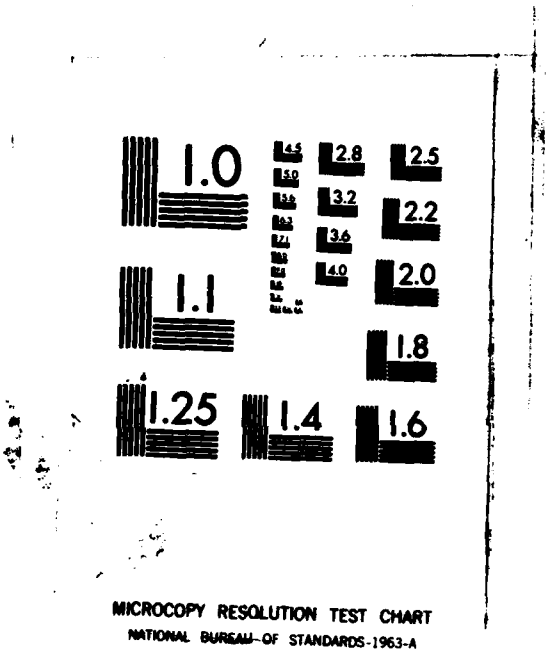
RECRUITER OBJECTIVES / SMOOTHED OBJECTIVES

E	ACTUAL VALUE	FITTED VALUE
7604	.6738	0.
7605	.7720	0.
7606	1.532	0.
7607	1.037	0.
7608	1.292	0.
7609	1.315	0.
7610	1.026	0.
7611	1.017	0.
7612	.5559	0.
7701	1.089	0.
7702	.9220	0.
7703	.8241	0.
7704	.7582	0.
7705	.8656	0.
7706	1.442	0.
7707	1.395	0.
7708	1.284	0.
7709	1.300	0.
7710	.7909	0.
7711	.8098	0.
7712	.4392	0.
7801	.9395	0.
[illegible]02	.8957	0.
[illegible]3	.6512	0.
[illegible]4	.4645	0.
[illegible]05	.7111	0.
7806	1.634	0.
7807	1.516	0.
7808	1.505	0.
7809	1.688	0.
7810	.7915	0.
7811	.6823	0.
7812	.3858	0.
7901	.8806	0.
7902	.7443	0.
7903	.6375	0.
7904	.9327	0.
7905	1.011	0.
7906	1.678	0.
7907	1.661	0.
7908	1.301	0.
7909	1.442	0.
7910	.7097	0.
7911	.6381	0.
7912	.3714	0.
8001	.8705	0.
8002	.7464	0.
8003	.6383	0.
[illegible]04	.9327	0.
[illegible]5	1.011	0.
[illegible]6	1.678	0.
[illegible]007	1.661	0.
8008	1.301	0.
8009	1.442	0.



AD-A139 995 A STUDY OF THE EFFECTIVENESS OF THE ARMY'S NATIONAL ADVERTISING EXPENDITURES VOLUME 3 APPENDICES(U) AYER (N W) INC NEW YORK 31 AUG 81 USAREC-SR-81-1-VOL-3 3/3

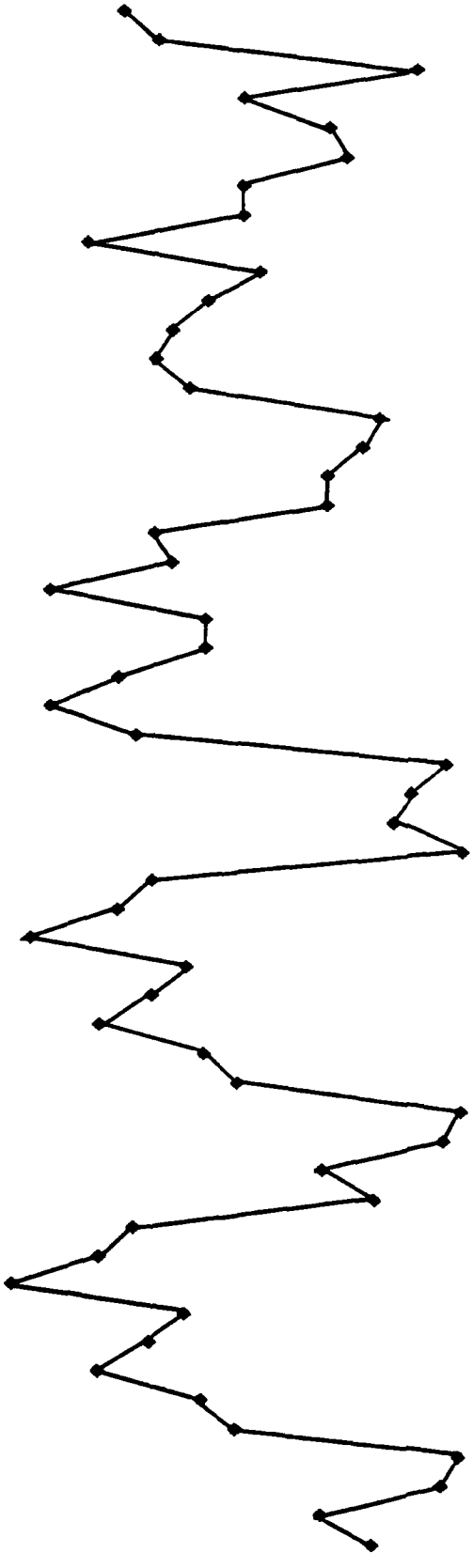
UNCLASSIFIED MDA903-79-D-0001 F/G 5/1 NL



RECRUITER OBJECTIVES / SMOOTHED OBJECTIVES

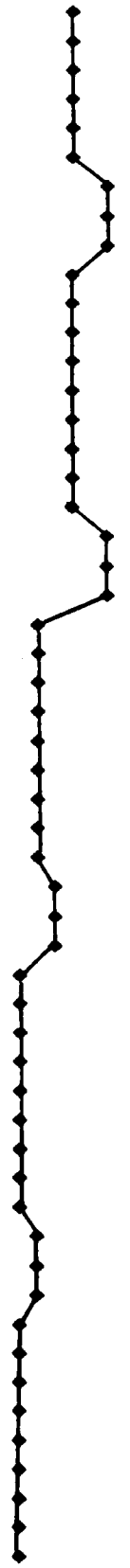
E	ACTUAL VALUE	FITTED VALUE
7604	.6738	0.
7605	.7720	0.
7606	1.532	0.
7607	1.037	0.
7608	1.292	0.
7609	1.315	0.
7610	1.026	0.
7611	1.017	0.
7612	.5559	0.
7701	1.089	0.
7702	.9220	0.
7703	.8241	0.
7704	.7582	0.
7705	.8656	0.
7706	1.442	0.
7707	1.395	0.
7708	1.284	0.
7709	1.300	0.
7710	.7909	0.
7711	.8098	0.
7712	.4392	0.
7801	.9395	0.
[illegible]02	.8957	0.
[illegible]3	.6512	0.
[illegible]4	.4645	0.
[illegible]05	.7111	0.
7806	1.634	0.
7807	1.516	0.
7808	1.505	0.
7809	1.688	0.
7810	.7915	0.
7811	.6823	0.
7812	.3858	0.
7901	.8806	0.
7902	.7443	0.
7903	.6375	0.
7904	.9327	0.
7905	1.011	0.
7906	1.678	0.
7907	1.661	0.
7908	1.301	0.
7909	1.442	0.
7910	.7097	0.
7911	.6381	0.
7912	.3714	0.
8001	.8705	0.
8002	.7464	0.
8003	.6383	0.
[illegible]04	.9327	0.
[illegible]5	1.011	0.
[illegible]6	1.678	0.
[illegible]007	1.661	0.
8008	1.301	0.
8009	1.442	0.

PLOT ◆=ACTUAL +=FITTED



RELATIVE PAY

'E	ACTUAL VALUE	FITTED VALUE	PLOT ◆=ACTUAL +=FITTED
7604	.9473	0.	
7605	.9473	0.	
7606	.9473	0.	
7607	.9473	0.	1976
7608	.9473	0.	
7609	.9473	0.	
7610	.9819	0.	
7611	.9819	0.	
7612	.9819	0.	
7701	.9391	0.	
7702	.9391	0.	
7703	.9391	0.	
7704	.9391	0.	
7705	.9391	0.	
7706	.9391	0.	1977
7707	.9391	0.	
7708	.9391	0.	
7709	.9391	0.	
7710	.9970	0.	
7711	.9970	0.	
7712	.9970	0.	
7801	.8654	0.	
7802	.8654	0.	
03	.8654	0.	
04	.8654	0.	
805	.8654	0.	
7806	.8654	0.	1978
7807	.8654	0.	
7808	.8654	0.	
7809	.8654	0.	
7810	.9131	0.	
7811	.9131	0.	
7812	.9131	0.	
7901	.8343	0.	
7902	.8343	0.	
7903	.8343	0.	
7904	.8343	0.	
7905	.8343	0.	
7906	.8343	0.	1979
7907	.8343	0.	
7908	.8343	0.	
7909	.8343	0.	
7910	.8912	0.	
7911	.8912	0.	
7912	.8912	0.	
8001	.8338	0.	
8002	.8338	0.	
8003	.8338	0.	
104	.8338	0.	
05	.8338	0.	
06	.8338	0.	1980
8007	.8338	0.	
8008	.8338	0.	
8009	.8338	0.	



Series - Relative Pay

Transformation - The ratio of monthly E1 pay to monthly civilian minimum wage rate